Written Direct: Michael Weitzman, M.D., U.S. v. PM 99-cv-02496 (D.D.C.) (GK)
UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA
_____
UNITED STATES OF AMERICA,) Civil Action No. 99-CV-02496 (GK)
Plaintiff,)
v.) Next scheduled appearance:
PHILIP MORRIS USA INC.,) Trial (ongoing)
f/k/a PHILIP MORRIS INC, et al.,)
Defendants.)
_____)
WRITTEN DIRECT EXAMINATION OF:
MICHAEL WEITZMAN, M.D.
SUBMITTED PURSUANT TO ORDER # 471
Written Direct: Michael Weitzman, M.D., U.S. v. PM 99-cv-02496 (D.D.C.) (GK)
Q. Could you please state your full name for the record? 1
A. Michael Lane Weitzman. 2
Q. Where do you currently live? 3
A. [DELETED]. 4
Q. Where do you currently work? 5
A. I work as the Executive Director of the American Academy of Pediatrics Center for Child 6
Health Research. 7
Q. Do you hold any other positions? 8
A. I am professor and associate chair of the Department of Pediatrics at the University of
9
Rochester School of Medicine and Dentistry. I am also the director of two federally funded 10
fellowship training programs in academic general pediatrics. 11
Q. Let's discuss your educational background. From where did you receive your 12
undergraduate degree? 13
A. From Brooklyn College. 14
Q. What year did you graduate? 15
A. I graduated in 1968. 16
Q. Where did you attend medical school? 17
A. The State University of New York Upstate Medical Center in Syracuse, New York. 18
Q. What year did you graduate? 19
A. I graduated in 1972. 20
Q. Are you board certified in any specialty? 21
A. Yes, I am board certified in Pediatrics. 22
Q. What is involved in obtaining your board certification? 23
A. I obtained my board certification in pediatrics through an accredited residency training
24
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program and by sitting for both written and oral boards in pediatrics. 1
Q. Where did you perform your internship? 2
A. At the State University of New York Upstate Medical Center in Syracuse, NY. 3
Q. In what year did you perform your internship? 4
A. 1972 – 1973. 5
Q. And where did you perform your residency? 6
A. Also at the State University of New York Upstate Medical Center campus. 7
Q. And in what specialty did you perform your residency? 8
A. Pediatrics. 9
Q. What year did you complete your residency? 10
A. 1975. 11
Q. Did you receive any honors during your residency? 12
A. I was chosen to serve as the chief resident for the training program. 13
Q. Besides your hospital activities, what else did you do during your residency? 14
A. During my residency, I began and ran the first Lead Poisoning Treatment Program in the 15
Syracuse area. As head of the Program, I was responsible for admitting patients and

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overseeing 16
their treatment for lead poisoning. 17
Q. Can you provide some specifics regarding this program? 18
A. The Childhood Lead Poisoning Treatment Program provided the medical care for all 19
children with elevated blood lead levels referred from practicing pediatricians in the Syracuse 20
area. In 1971, the Onodoga County Health Department received a grant from the CDC in order 21
to begin screening children for lead poisoning. Children whose screening tests revealed high 22
levels of lead were referred to the hospital for further diagnostic testing and treatment. 23
Q. What did you do following the completion of your residency? 24
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A. When I left my residency, in addition to attending the Maxwell School of Public Health 1
Administration, I attended on the ward supervising resident activity concerning hospitalized 2
children and continued to run the Childhood Lead Poisoning Treatment Program. 3
Q. When did you leave that position? 4
A. I left that position in 1976 to move to Boston where I was a Research Fellow in the 5
Department of Health Services at the Harvard School of Public Health between 1976 and 1977. 6
During that time, I received training in research methodology. 7
Q. Did you hold any other positions during this time period? 8
A. I served as a faculty member and clinician at the Boston Children’s Hospital Medical 9
Center, where I had the title of Assistant Visiting Physician. I also achieved the rank of
Assistant 10
Professor in the Dept. of Health Services in the Harvard School of Public Health between
1977 11
and 1979. 12
Q. What is an Assistant Visiting Physician? 13
A. It is a title given to physicians with privileges to admit patients to Boston Children’s
14
Hospital Medical Center. 15
Q. What were your duties in that position? 16
A. My responsibilities included taking care of my own panel of patients in the outpatient
17
department of Boston Children’s Hospital Medical Center, caring for these patients when they 18
were admitted to the hospital, taking night call for all clinic patients, and supervising the
clinical 19
education of residents and fellows at the Boston Children’s Hospital Medical Center as well as 20
medical students from the Harvard Medical School. 21
Q. When did you leave that position? 22
A. I left that position in 1979. 23
Q. Any other employment during this time period? 24

A. I worked one evening per week and one weekend per month caring for adults with severe 1
developmental disabilities at the Fernald State School in Waltham, Massachusetts. 2
Q. What did you do following this job? 3
A. In 1979, I moved to the Boston University School of Medicine Department of Pediatrics 4

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as an Assistant Professor. I proceeded to stay at the school in a variety of roles until 1990.
5
Q. And how did you obtain that position? 6
A. I was recruited by the Chairman of the Dept. of Pediatrics at Boston University and 7
Boston City Hospital. 8
Q. What were your duties in that position? 9
A. In the ten years that I was at Boston City Hospital and Boston University, I had a variety 10
of roles. Generally, across all ten years, I continued to see and care for my own panel of
patients 11
in an outpatient setting, took night call on a regular basis, and cared for patients when
they were 12
hospitalized at Boston City Hospital. 13
Q. Any other duties? 14
A. For those 10 years, I also supervised residents and medical students caring for patients. 15
Q. What was your position when you started at Boston University? 16
A. I started as an Assistant Professor in 1979. 17
Q. Were you ever promoted? 18
A. Yes, I was promoted to Associate Professor of both Pediatrics and Public Health in 1984. 19
I was promoted to the position of Professor of Pediatrics at the Boston University School
of 20
Medicine. After moving to the University of Rochester, I carried the title of Adjunct Associate 21
Professor of Public Health. 22
Q. Did you have any other teaching duties? 23
A. Yes, I did. For a five year period from 1985 until 1990, I taught a number of courses at
24

the Boston University School of Public Health. 1
Q. While at Boston University, did you have any duties outside of teaching? 2
A. In addition to my academic promotions, I was actively involved in clinical care, public
3
health education, and research. 4
Q. During this period, did you have any jobs outside of Boston University itself? 5
A. I served as the Director of Maternal and Child Health Services for the City of Boston.
In 6
this capacity I oversaw all maternal and child health services run by the Health Department 7
including home visitation programs, Sudden Infant Death Syndrome programs, lead poisoning 8
and injury prevention programs. 9
Q. Any other outside duties? 10
A. I also became the Director of General Pediatrics during this period in which capacity I
11
was responsible for the clinical care provided to all outpatients at Boston City Hospital
who were 12
children and for the career development of the faculty. I also was involved in a number of
large 13
scale research projects funded both by private foundations and federal agencies. 14
Q. Any other duties that you'd wish to discuss? 15

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A. I also wrote the grant and ran the program that trained academic general pediatric faculty. 16
Q. When did you leave these jobs? 17
A. I left these jobs in 1990. 18
Q. What was your next position? 19
A. When I moved to Rochester, New York, I assumed a number of positions. I was 20 appointed as a Professor and Associate Chair of the Department of Pediatrics at the University of 21 Rochester School of Medicine and Dentistry, where I also carried the titles of Director of the 22 Division of General Pediatrics, Fellowship Director for Academic General Pediatrics at the 23 University, and Pediatrician-In-Chief at the Rochester General Hospital, a large hospital that has 24

about 40,000 pediatric visits per year. 1
Q. How did you obtain this position? 2
A. There was a national search and the search committee reached out to me to see if I was 3 interested. I then interviewed for the position and was, fortunately, offered it. 4
Q. What were your duties in this position? 5
A. As Pediatrician-In-Chief at the Rochester General Hospital, I oversaw all aspects of the 6 care of all children who came to that institution to our ambulatory care center, our emergency 7 room, our inpatient unit, and for all newborns born at our hospital. 8
Q. Was there extensive pediatric care available at Rochester General? 9
A. All levels of pediatric care, short of intensive care unit therapy, were available at 10 Rochester General Hospital. We had an inpatient unit for children and adolescents, a well baby 11 nursery, a level 2 nursery, an outpatient department, and a pediatric emergency room. 12
Q. Did you have any other duties in this position? 13
A. As Pediatrician-In-Chief, I also was responsible for the career development of 14 approximately two dozen members of the department, as well as for all medical student and 15 resident education that went on at this hospital. Because all University of Rochester residents in 16 pediatrics spend a third of their residency at Rochester General Hospital, I was responsible for 17 the clinical care they provided and overseeing the education that they received. 18
Q. How long did you serve in this position? 19
A. I served in this capacity for 9 years. 20
Q. In this nine-year period did you hold any other positions? 21
A. In addition to being the Pediatrician-In-Chief at Rochester General, I was the Director of 22 the Division of General Pediatrics. In that capacity, I was responsible for the clinical care and 23 career development for the around thirty faculty members located at two separate hospitals and 24

the quality of care that they provided. In addition, I served as the Associate Chairman for 1 Community Affairs for the Department of Pediatrics at the medical school and directed the 2

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fellowship program in Academic General Pediatrics. 3
Q. What were your duties as Associate Chairman for Community Affairs? 4
A. As Associate Chairman for Community Affairs, I oversee relations and collaborations 5
between the Department of Pediatrics and all community pediatricians. In that capacity, I
6
represent the department in its interface with clinical pediatricians around issues that
concern the 7
care of children in community settings. As an Associate Chair, I also am part of the Executive 8
Committee of the Department of Pediatrics, and am heavily involved in decision making at the 9
highest level for the department. 10
Q. Do you still hold that position? 11
A. Yes, I still hold that position. 12
Q. Did you hold any other positions? 13
A. I was also Director of the fellowship program for General Academic Pediatrics. 14
Q. What does the term "General Academic Pediatrics" mean? 15
A. General Academic Pediatrics refers to hospital and medical center based academic 16
pediatricians who provide medical care to the children who come to the hospital for their
care. 17
These children are largely minorities and poor children. These doctors are also responsible for 18
the majority of education that medical students and residents receive in outpatient pediatrics. 19
Finally, they also tend to perform the majority of non-bench research concerning children’s 20
health. 21
Q. What is non-bench research? 22
A. It is clinical research, focusing on epidemiology and health services. For example, a
23
bench researcher might do basic science to invent a new vaccine for meningitis in children. 24

General academic pediatricians doing research in clinical epidemiology could then evaluate how 1
well the vaccine works to prevent disease, and then do health services research to determine why 2
people are not receiving the vaccine and how those barriers can be overcome. General academic 3
pediatricians could also perform the original work describing the clinical features of the 4
particular type of meningitis and the extent of its impact in the population and risk factors
for bad 5
outcomes. 6
Q. So, there is a lot of medical research done to improve children’s health that is not 7
performed in laboratories? 8
A. Yes. People tend to think of medical research involving just the laboratory experiments, 9
but even with a new drug, there’s a lot of scientific work going on before and after the lab
10
research. In fact, when you are talking about prevention at the population level, the research may 11
not involve bench science at all. 12
Q. How long did you hold that position? 13
A. I was Director of the Division of General Pediatrics at the University of Rochester for

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9 14
years. 15
Q. Getting back to your current position, you are now the Executive Director of the
16
American Academy of Pediatrics' Center for Child Health Research? 17
A. Yes. 18
Q. What is the Center for Child Health Research? 19
A. The Center for Child Health Research is an independent operating branch of the 20
American Academy of Pediatrics, the professional organization that represents this
nation’s 21
pediatricians. The Center for Child Health Research is the only national center for
child
health 22
research in the United States, as well as the only research center that is affiliated
with a
23
professional group of physicians. 24

Q. Why was it established? 1
A. The Center for Child Health Research was created by the American Academy of 2
Pediatrics because it recognized that the health problems of the nation’s children were
too
great 3
to be dealt with by one professional group alone. Thus, the Academy created the Center
with 4
three overarching goals. 5
Q. What were those goals? 6
A. The first was to identify and champion, both to funders and the pediatric research 7
community, priority areas for child health research. The second was to stimulate,
catalyze, 8
coordinate, and conduct that research. The third priority was to synthesize information
and 9
identify new methods by which information that would improve the health of the nation’s
10
children would be identified and implemented. 11
Q. Who is involved in these activities? 12
A: One group involved is an independent Board of Directors, which includes three
members 13
from the American Academy of Pediatrics, an association of pediatricians which has over
60,000 14
members. The remaining nine board members are selected from the leading researchers
and 15
scholars concerning child health from across the nation. 16
Q. Who are some of these researchers and scholars? 17
A. They include former Surgeon General Julius Richmond, Cathy DeAngelis (Editor of
the 18
Journal of the American Medical Association), and many other luminaries from within
the fields 19
of pediatrics, law, family practice, and health policy. 20
Q. Who else is involved with the Center’s activities? 21
A. In addition to the Board of Directors, the Center has approximately 10 people
working
on 22
Center related activities and on the budget at the University of Rochester. They
include a
23
medical student from the University of Rochester who has taken a year out to work on
research 24

involved in the Center. 1
Q. Can you more specifically describe the Center’s employees, please? 2
A. The Center has approximately 10 employees at the University of Rochester, 3
approximately another 10 employees at the American Academy of Pediatrics, one full

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time 4
faculty member and a secretary at the University of Vermont, and then a series of collaborations 5
with people located around the country. 6
Q. Any other personnel? 7
A. There are increasing numbers of medical students who participate in research projects
at 8
the Center but they are not employees. 9
Q. Does the Center work with any outside child health researchers? 10
A. As a national child health center, the Center collaborates with over 100 other researchers 11
from other institutions around the country. In addition, the Center collaborates with a cadre of 12
social scientists who are located in Chicago who work on developing measures of functional 13
status of children. Finally, we have the Pediatric Research in the Office Setting Network,
which 14
consists of over 2000 pediatricians in practice who participate in office-based research
doing 15
important work on violence prevention, counseling, recognition of child abuse by pediatricians, 16
ways to increase immunization rates of children, and more recently on obesity prevention, 17
tobacco cessation and in the past, age of onset of puberty in girls. 18
Q. What are some of the pediatric issues that the Center has researched? 19
A. The Center in its first five years has published approximately 90 peer-reviewed journal
20
articles and a number of books. 21
Q. What were the subjects of the articles? 22
A. The research papers we have published have focused on subjects such as preventive 23
health services for children, the needs of Latino children in the United States, a number
of mental 24

health issues of children, obesity, the influences of tobacco and environmental tobacco smoke on 1
children, and the attitudes of the public towards pediatricians becoming more involved in
2
smoking cessation activities for parents. 3
Q. Any other papers relating to smoking and children? 4
A. The tobacco influences have included a paper in the Journal of the American Medical 5
Association on the relationship between parental smoking and dental caries in children as
well as 6
a number of other papers concerning environmental health influences on children. 7
Q. What are some of the books the Center has prepared? 8
A. In October, the Center will publish a book entitled, About Children, which is aimed at
9
policymakers at all levels in the United States and discusses many of the most important
social 10
and environmental influences on child health and well-being. It is being published as a 11
centerpiece of the American Academy of Pediatrics 75th Anniversary celebration. In addition, 12

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last month we published, along with Child Trends, a major social science research institution in 13
the Washington DC area, a book entitled, Early Childhood Development in a Social Context. 14
This book reviewed many of the most important malleable influences on child development and 15
school readiness. Finally, earlier this year we also published a Supplement to Pediatrics
on the 16
unique vulnerabilities and resiliencies of children to environmental influences. 17
Q. When will the Supplement be published? 18
A. The Supplement was published in April, 2004. It had over 30 papers with over 50 19
authors, who were nationally or internationally known authorities in their field. As the
person 20
who received the grant from the EPA, I chose my co-editor and the majority of topics and
21
individuals to write on those topics. I also oversaw the administration of correspondence
with 22
them, the distribution of manuscripts for outside review, and the final coordination and
approval 23
for the articles. 24
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Q. What else does the Center do? 1
A. The Center also informs the pediatric community about new information that is being 2
generated and works to link the pediatric community to other professional groups doing research 3
concerning the well-being of children. 4
Q. How is it funded? 5
A. The Center is funded with modest infrastructure support by the American Academy of 6
Pediatrics, the University of Rochester, and through grants obtained from the federal government 7
and from private foundations. 8
Q. From what federal agencies does the Center receive funding? 9
A. The center has received funding from the following federal agencies: The Maternal and 10
Child Health Bureau, the Centers for Disease Control and Prevention, the Agency for Health 11
Research and Quality, the National Institutes of Health, and the Environmental Protection
12
Agency. 13
Q. From what private foundations does the Center receive funding? 14
A. The Center has received funding from the Robert Wood Johnson Foundation, the 15
American Legacy Foundation, and the Commonwealth Foundation. 16
Q. What are your duties with regard to the Center? 17
A. My duties are those of an Executive Director, who oversees the work of all the 18
individuals in the Center. As such, I am responsible for the hiring of employees as well as
the 19
identification and implementation of much of the large national dataset research. In addition, I 20
am responsible for the identification of priority areas for research, as well as the proper
child 21
health researchers to work on that research. 22
Q. Any other duties? 23
A. I also oversee the convening of the multiple groups that we bring together concerning

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mental health issues of children, income and equality of child well being, Latino children's 1
health, tobacco as a pediatric issue, the interface of information technology and pediatrics, and a 2
number of other issues. I have also been responsible for identifying most of the authors
for our 3
book entitled, About Children. 4
Q. Are you involved with any public speaking on Center issues? 5
A. Yes. I have given numerous speeches on tobacco-related topics both in the United States 6
and abroad. Most recently, I discussed the effects of tobacco on children's health at the
annual 7
meeting of the Japanese Society of Ambulatory and General Pediatrics in Oita City, Japan. I 8
have also presented the Center's findings regarding tobacco at the National Conference on 9
Tobacco and Health in Washington, D.C. in 2003. There are numerous other talks that I have 10
given regarding tobacco and its effects on children's health, including speeches for the
Centers 11
for Disease Control, the Maternal and Child Health 2010 Conference, the National Initiative for 12
Children's Healthcare Quality, and the Pediatric Academic Societies. 13
Q. How did you end up in your current position? 14
A. There was a national search by the American Academy of Pediatrics for an Executive 15
Director. Because of my visibility in the academic and research world, as well as the American 16
Academy of Pediatrics, I was asked to interview for this position and I was chosen by the
Search 17
Committee. 18
Q. How were you visible in the academic and research world? 19
A. My visibility was due to my longstanding experience as a general pediatrician who did
20
research and because of my activities with the American Academy of Pediatrics. 21
Q. Please describe those activities. 22
A. At the Academy, I had been a member of and directed the Committee on Community
23
Child Health Services, which is the committee that establishes policy statements for socially 24

disadvantaged children in the United States, including homeless children, illegal immigrant 1
children, immigrant children in general, and migrant farmer laborer children. 2
Q. You mentioned your teaching experience. Are you currently teaching any classes at 3
the medical school? 4
A. I co-teach a course involving an overview of health services research that extends through 5
most of the academic year for our fellows in Academic General Pediatrics, Adolescent Medicine, 6
as well as PhD. students from the School of Nursing and for child psychology and psychiatry 7
fellows. I also teach in several classes in the Department of Community and Preventive
8
Medicine, and present grand rounds regularly. Finally, I attend morning report with our

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residents 9
one to three mornings each week, supervise and teach residents in our continuity clinic at
the 10
University of Rochester as they provide care to patients ½ day per week, and attend on the 11
inpatient ward once per year for two weeks. 12
Q. Any other teaching responsibilities? 13
A. I oversee our two fellowship training programs in academic general pediatrics, with 5-
7 14
fellows per year. They are located with me and I oversee all aspects of their training as
fellows. 15
Q. Do you yourself conduct any research? 16
A: Yes. I conduct research on a wide variety of child health issues. These issues have 17
included tobacco influences on children, the attitudes of pediatricians towards tobacco 18
counseling, obesity in children, child mental health, and health preventive services for
children. 19
Q. In your years as a health researcher and professional, have you received any 20
awards? 21
A. I have won a number of awards through the years. I have won the Research Award from 22
the Ambulatory Pediatric Association, its most prestigious award for lifetime achievement in 23
research. 24

Q. What is the Ambulatory Pediatric Association? 1
A. The Ambulatory Pediatric Association is the professional organization of the 2,000 2
academic pediatricians around the nation. 3
Q. For what research did you receive this award? 4
A. It was for my lifetime body of research on child health issues. 5
Q. Any other awards from this Association? 6
A. I also have won the teaching award from the Ambulatory Association in recognition of 7
more than ten years of running the two federally funded Academy General Pediatrics Fellowship 8
programs at the University of Rochester. 9
Q: Is it unusual to win both awards? 10
A. Yes. I am the only member out of the 2,000 members of the Ambulatory Pediatric 11
Association to have won both the research award and its teaching award. 12
Q. Have you won any other teaching awards? 13
A. Yes. I won the Boston University Faculty Teaching Award. 14
Q. Why did you win this award? 15
A. The Boston University Faculty Teaching Award was a consequence of being voted by the 16
pediatric trainees at the Boston University School of Medicine as the best faculty teacher.
17
Q. Any other honors or awards? 18
A. This past year, I was elected to the Best Doctors in America. In addition, I have been
19
appointed to prestigious national committees that are a consequence of meticulous reviews 20
involving experts in various fields. Among these are my previous service on the Centers for 21
Disease Control and Prevention Committee on Children With Disabilities, my appointment and 22
service on the Advisory Committee on Childhood Lead Poisoning Prevention Center for

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five 23
years at the Centers for Disease Control and Prevention, my selection as overseer for the
CDC’s 24

workgroup on the Effects of Low Level Lead on Children. 1
Q. Any others? 2
A. I served on the Advisory group to the Children’s Health Protection Branch of the 3
Environmental Protection Agency, and as an ad hoc reviewer for the National Institute of
Child 4
Health and Development. Finally, I currently serve on the Institute of Medicine’s committee on 5
Ethical Issues Involved in Housing Related Research of Children and have been and continue to 6
serve on the National Advisory Committee of the Robert Wood Johnson Foundation Generalist 7
Faculty Scholars Program. 8
Q. What is the National Advisory Committee's purpose? 9
A. The National Advisory Committee of the Robert Wood Johnson Generalist Faculty 10
Scholars Program is the committee that runs this national career development program for young 11
faculty members in generalist fields in medical schools around the United States in family 12
practice, internal medicine and pediatrics. The Committee’s responsibility includes the review of 13
all applications for this program, the interviewing of applicants and the choosing of them,
and 14
mentoring them. 15
Q. What exactly did the Ethics of Research on Children's Housing involve? 16
A. The Institute of Medicine Committee of Ethics of Research on Children’s Housing is 17
putting together, as the Institute of Medicine does for a large number of issues, a summary 18
document about what are the ethical obligations of researchers who are doing research on
various 19
aspects of children’s homes. Any time one visits one’s home as part of research; there are
20
different obligations that kick into play that would not come up in clinically situated biomedical 21
research. 22
Q. How much time did this activity involve? 23
A. I probably spend on average half a day a week, almost exclusively done in the evenings 24

and weekends, on this for the past several months. This pattern of activity will continue at
least 1
for the next several months. 2
Q. How long did you serve on this Committee? 3
A. I have been on this committee for approximately one year and I believe that it goes for
4
another 12 to 18 months. 5
Q. Any other government-related activities? 6
A. I am an Ad Hoc reviewer for National Institute of Child Health and Development. 7
Q. What are you reviewing for this institution? 8
A. I review grant applications for a variety of types of grants that are submitted by academic 9
individuals from Universities around the country for federal funding for research that

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deals with 10
children’s issues. 11
Q. What type of grant applications? 12
A. During the grant review cycle that I most recently participated in, the grants were from
13
researchers investigating issues of better understanding young influences, neurocognition,
and 14
school achievement of children. 15
Q. How much time does this activity take? 16
A. This activity took approximately one week last year. 17
Q. Have you ever published any of your research results? 18
A. Yes. I have published 114 peer reviewed articles and 131 abstracts. 19
Q. In what journals did these articles appear? 20
A. They appeared in publications such as The Journal of American Medical Association, 21
Pediatrics, The Journal of Pediatrics, Archives of Pediatrics and Adolescent Medicine, and The 22
American Journal of Public Health, Neurotoxicology and Teratology. 23
Q. Are you being compensated for your work as an expert in this case? 24
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A. No, I am not being compensated personally. The compensation rate of $300 per hour for 1
my time on this case is being given to the Center so that it can continue its work. 2
Q. Have you ever previously worked with the federal government on pediatric health 3
issues? 4
A. Yes, I have served in a consultative purpose to the Centers for Disease Control and 5
Prevention and I have served on the CDC’s Childhood Lead Poisoning Expert Advisory 6
Committee. I currently lead the CDC’s Workgroup on the Effects of Blood Lead Levels Less 7
Than 10 (micrograms per liter) on Children. I served on the CDC’s Childhood Disabilities 8
Advisory Committee as well as the Advisory Board to the Environmental Protection Agency’s 9
Office of Child Health Protection, and have conducted and published the results of what is 10
known about the interface of information technology and pediatric practice for the Agency for 11
Health Research and Quality. Most recently, I have co-edited and published a supplement to 12
Pediatrics on behalf of the Environmental Protection Agency on the state of knowledge about 13
how children’s biologic vulnerability to a variety of environmental exposures differs from what 14
we currently know about these exposures effects on adults. As discussed earlier in this 15
testimony, that supplement contains an article summarizing what is known about the effects of 16
prenatal and environmental tobacco smoke on children. 17
Q. What does the Supplement state on this topic? 18
A. This article reviews the medical literature regarding both prenatal and postnatal 19
environmental tobacco smoke exposure and its effects on the health of children. It noted
that a 20
large body of literature links both prenatal maternal smoking and children’s ETS exposure to 21
decreased lung growth, increased rates of respiratory tract infections, otitis media and
childhood 22
asthma. There is a dose-response effect, with increased tobacco exposure leading to

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increased 23
incidence of these problems. Finally, the literature demonstrates that Sudden Infant Death
24

Syndrome, behavioral problems, neurocognitive deficits, and increased rates of adolescent 1
smoking have all been associated with prenatal and postnatal exposure to smoke. 2
Q. What did your work for the CDC entail? 3
A. The work with CDC entailed going to Advisory Committee meetings several times a year 4
usually in Atlanta or Washington, DC, doing presentations and deliberations at those meetings, 5
and working on workgroups that provided recommendations to the public health community and 6
the pediatric community on how to prevent and manage childhood lead poisoning. The work for 7
the Less Than 10 Workgroup entailed identifying and convening some of the leading researchers 8
in the area of children’s lead poisoning, air quality measurement, epidemiology, iron deficiency 9
anemia, toxicology and clinical pathology together to review the state of knowledge about low 10
level lead poisoning. Information was provided to the CDC, which will publish it in the 11
Morbidity and Mortality Weekly Review. 12
Q. Have you performed any work for any state or local government agencies? 13
A. Yes. I have served on the New York State Lead Advisory Committee, and I have 14
convened and published the proceedings of a meeting on Environmental Health on Children in 15
New York State. I have also served on the Massachusetts Maternal and Child Health Advisory 16
Committee for the State Health Department. Finally, I served for five years (1985 to 1989) as the 17
Director of Maternal and Child Health for the City of Boston. 18
Q. Turning to the opinions you hold in this case, is the issue of tobacco smoke exposure 19
of fetuses and children an important one in the public health community? 20
A. Yes, it is very important. 21
Q. How common is this exposure among fetuses and children? 22
A. Currently, about 11.4 % of all pregnant women smoke during pregnancy. 23
Q. Why do you believe that this is an important health issue? 24

A. Most women relapse and begin to smoke again after the delivery of a baby. As a result, a 1
more accurate figure is somewhere around 25-30% of children in America whose parents report 2
that they smoke at home. Furthermore, when you look at nationally representative data 3
measuring cotinine levels, cotinine being the major metabolite of nicotine that is degradation 4
product, it is then clear that almost 90% of our children are exposed to secondhand smoke. If we 5
don’t continue to pay attention to this and educate the public, they may be overridden by
other 6
messages that induce them to smoke during pregnancy and we could lose the progress that we’ve 7
already obtained. 8
Q. Why would they be higher than reported? 9
A. This is because such rates are based on parent report, not serologic evidence. 10
Q. Is the exposure confined to the prenatal period only? 11
A. This exposure does not just occur during the prenatal period but occurs throughout life. 12

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In fact, despite the fact that 25-30% of American children live in houses with a smoker,
you can 13
measure the metabolite of nicotine, cotinine, in almost 90% of America's children using standard 14
laboratory procedures. 15
Q. Has this tobacco smoke exposure been linked to any child health problems? 16
A. Secondhand smoke has been linked to many child health problems. It is the leading cause 17
of low birth weight in the United States, accounting for 70% of all low birth weight cases
there. 18
Q. What is the significance of this figure? 19
A. This has enormous educational and school achievement and economic consequences to it. 20
First, low birth weight babies have more neurocognitive problems. Second, many of them are 21
quite sick and experience a disproportionate use of healthcare services. Third, research
has 22
shown that these children go on to do poorly in school. Fourth, it has been well recognized for 23
some time that smoking exposure in the first year of life results in higher rates of pneumonia and 24

hospitalization at quite an emotional and financial cost. Fifth, this smoking is the leading
1
preventable cause of reoccurring ear infections among children. 2
Q. Do ear infections form a serious concern for children? 3
A. Yes, they do. Ear infections are the leading reason why children in the United States 4
receive antibiotics. This creates an enormous economic and public health problem which drives 5
the cost of antibiotics up and also leads to increased rates of bacteria resistant to more
common, 6
more familiar, less expensive and less dangerous alternatives. Tobacco smoke exposure is
the 7
leading cause of recurrent otitis media and so indirectly endangers the health of the entire
world's 8
public. This is due to the emergence of drug resistant bacteria. As a result, it is not science 9
fiction to say that it is within the realm of possibility that there will be emergence of
resistant 10
bacteria at some point in the foreseeable future to all antibiotic alternatives that we have
available 11
to us. 12
Q. Are there any other known effects? 13
A. Other studies have linked it to increased rates of dental caries, diminished lung size,
14
increased rate of risk for the dreaded Metabolic Syndrome among overweight children, which 15
portends type II diabetes and premature cardiac death, and to a number of neurocognitive
16
problems that we will discuss in this testimony. 17
Q. Has there been scientific literature prepared on this issue? 18

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A. The scientific literature on the relationship between children's neurocognitive 19
development and exposure to prenatal tobacco smoking or environmental smoking or 20
secondhand smoke after birth is quite consistent in showing an association between these
21
exposures and neurotoxic effects on the child. 22
Q. What does the scientific literature say? 23
A. That there is a strong and consistent association between prenatal tobacco smoke 24

exposure, secondhand smoke exposure after birth, and behavior problems, mental health
1
problems, and decreased intellectual potential. 2
Q. Are you familiar with the term "neurotoxic?" 3
A. Yes, I am. 4
Q. What does the term neurotoxic mean? 5
A. Neurotoxic simply means that something is toxic to the nervous system. 6
Q. Can you explain what the neurotoxic effects maternal smoking causes for children 7
are? 8
A. Yes. The literature points out a concrete number of ways in which maternal smoking is 9
associated with evidence of neurotoxicity of the child. Research has consistently found an
10
alteration both in structure and functioning. The alteration in structure finding was noted
in 11
animal studies, and the alteration in function comes from both animal studies and human
12
observational epidemiologic studies. 13
Q. What structural alterations were discovered? 14
A. Structurally, nicotine has been found to prematurely shift developing neurons in the brain 15
from proliferation, where immature neurons increase in number, to differentiation, when these 16
neurons take on their specific differential functions. Thus, there are fewer neurons that
exist, but 17
the neurons that do exist have increased functioning of specific receptors called nicotinic
18
acetylcholine receptors. This upregulation has been demonstrated to elicit damage in rodent and 19
primate developing brains. In addition, animal studies have demonstrated that chronic nicotine 20
exposure prenatally can disrupt the normal development of the auditory cortex, which is the part 21
of the brain involved in hearing, which is essential to cognitive processing and function.
22
Furthermore, nicotine suppresses the synthesis of DNA in the newborn rat brain, especially in the 23
cerebellum, the part of the brain that controls coordination. 24

Q. What alterations in functioning were discovered? 1
A. The studies found irritability, increased hyperactivity, negative responses to the 2
environment in the first several months of life, crying and fussiness, conduct disorders as
early as 3
two to three years of age, persistent as well as an increasing amount of conduct disorders
and 4
mental health problems as the subjects got older. 5

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Q. Any other findings? 6
A. The studies also consistently demonstrated findings that are consistent with attention 7
deficit hyperactivity disorder, a condition that affects many American children. 8
Q. Please describe these findings with a little more detail. 9
A. In the first such study of its kind to come out of the Human Genome Project, published in 10
the Journal of Pediatrics in July, 2003, there has been found to be an increased susceptibility to 11
mother’s smoking during pregnancy to rate of developing attention deficit hyperactivity disorder 12
later in childhood amongst children whose mothers had a particular genetic pattern. 13
Q. Is this finding important? 14
A. This is a remarkable finding. The very first product of the Human Genome Project to 15
demonstrate long-term behavioral consequences of gene- environmental exposures of children 16
and it is tobacco that is associated with ADHD, which provided a biologic mechanism, if you 17
will, of the strongest sort between the blueprint of life and smoking during pregnancy in
putting 18
children at risk. Only certain women that smoke will have children with increased risk. That 19
explains a big piece of the puzzle as to why studies show increased rates of attention deficit 20
activity disorder in children whose mothers smoke but not all such children are affected.
21
Q. Is this exposure associated with other child health risk factors? 22
A. Yes, it is associated with other child health risk factors. 23
Q. What are some of these risk factors? 24

A. Children whose mothers smoke are also more likely to be exposed to poverty, as well as 1
to less educated and more depressed/anxious mothers. 2
Q. How do these factors work with tobacco smoke exposure to impact children's 3
behavioral and cognitive outcomes? 4
A. There are many factors in children’s life that influence their behavioral and cognitive
5
outcomes. There is child development literature that shows that past a certain number of
insults 6
or diminution in capacity and behavior, children have remarkably high rates of probability of 7
falling off the curve and failing in life. Unfortunately, many of these influences are 8
multiplicative in nature. 9
Q. How are these influences multiplicative in nature? 10
A. Take for example, tobacco smoke. In a study that we did about kindergarten and first 11
grade retention, we showed if you had a low birth weight, a mother that smoked, behavior
12
problems, and recurrent ear infections, all of which are associated with a mother’s smoking, you 13
were almost 10 times more likely to have to repeat kindergarten or first grade. 14
Q. What are some of the other risk factors for neurocognitive problems? 15
A. Other risk factors for neurocognitive problems include low birth weight, poorly educated 16
parents, living in a single household, poverty, bad schools, and mental health problems.

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Each of 17
these factors comes into play with children. 18
Q. Are most neurocognitive problems caused by only one risk factor? 19
A. No, they are not. Our tendency to think of one cause resulting in one consequence is 20
oversimplified and it is increasingly recognized that most diseases are multifactorial in
nature. In 21
fact, even infectious diseases in many cases, are multifactorial. Not everybody exposed to
the 22
agent that causes the disease will get the disease or if they get the disease, there is a wide
range of 23
responses. 24

Q. Can you please provide an example of this? 1
A. Many of us carry streptococcal bacteria in our heart at all times and don’t get a sore
throat 2
or rheumatic fever. However, because these risk factors cluster together, they heighten the risk 3
for those kids exposed to tobacco smoke and make it very difficult to separate the effects
of each 4
individual risk factor, although by using statistical modeling procedures, one can account
for the 5
influence for many of the known things that cluster together. 6
Q. How do the risk factors heighten the risk for kids exposed to tobacco smoke? 7
A. Because these risk factors cluster together, they heighten the risk for those kids exposed 8
to tobacco smoke and make it very difficult to separate the effects of each individual risk
factor. 9
They also increase the damage done by each of the individual risks. 10
Q. Have studies been performed to discover why tobacco smoke exposure causes
these 11
neurocognitive deficits? 12
A. Yes. Human observational studies and experimental animal studies were performed to 13
build an opus to prove, if you will, that exposure to tobacco prenatally and to secondhand
smoke 14
post-natally are associated with and cause neurocognitive deficits. 15
Q. How do these studies work to provide information on these conditions? 16
A. Human observational studies and experimental studies build a body of evidence about the 17
association from which the scientific and public health community then draws
conclusions about 18
cause. 19
Q. What specific role do human epidemiologic studies play? 20
A. Human epidemiologic studies build evidence about the association between the
exposures 21
and behavior and cognition in children and adolescents. That literature allows us to weigh
in on 22
whether we believe that there is a causal relationship; that is, that it is not just that it
occurs more 23
commonly amongst kids with these problems but that we are able to build sufficient
evidence 24

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that we convince others and ourselves that the evidence is strong enough to believe that
the 1
exposure is in fact, causing the problems that we are finding. 2
Q. What do the human epidemiological studies show? 3
A. The epidemiologic literature is very consistent demonstrating that children with prenatal 4
and postnatal exposures have increased rates both of mental health problems and neurocognitive 5
problems. As we have already discussed, there are a number of things that tend to co-vary
with, 6
compound, and confound the effects of tobacco smoke exposure. Epidemiologic studies become 7
then limited in those areas to identify to everybody’s satisfaction that the single, isolated
8
influence is in fact, exposure to tobacco smoke. 9
Q. Can animal studies help to remedy this confounding? 10
A. With animal studies, you do not have any of the social confounding of the likelihood 11
being that the subjects who are exposed to tobacco products come from poorer homes with more 12
anxious or depressed parents. In these studies involving mice and monkeys, it is the tobacco 13
smoke that is associated with increased rates of negative outcomes. 14
Q. Are there difficulties related to experimental animal studies? 15
A. The problem in using experimental animals is that the human species is extremely 16
complicated, neurocognitively speaking, and so there are certain things that you can feel
17
uncomfortable about by extrapolating from animal studies to humans. There is a difference 18
between a mouse brain and an animal brain such as a monkey or human brain and our ability to 19
measure neurocognitive performance, so one can raise questions about applying these findings 20
definitively to humans. However, if the studies are consistent with epidemiologic findings, then 21
they provide powerful supporting evidence. 22
Q. Are animal studies better suited for this research? 23
A. No. The animal models simply provide an additional way to convince individuals of 24

conscience and considerable intelligence in the scientific and medical communities that there is a 1
causal relationship. 2
Q. Should we just focus on performing animal studies? 3
A. No. Science is based on research – you search and you search and you search, and if 4
multiple settings, using different methods and populations, come up with similar findings,
then 5
you believe the findings are definitive. 6
Q. What mechanistic questions does maternal smoking evoke in the area of 7
neurocognitive functioning? 8
A. The questions include the actions of nicotine on the fetal brain and the maternal-fetal
unit 9
as well as the influence of other toxic smoking agents such as carbon monoxide. 10
Q. Have animal studies provided sufficient data to implicate any of the agents 11
associated with maternal smoking? 12
A. Yes, animal studies, again, have provided sufficient data to implicate at least nicotine

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as 13
being causally associated with these findings that we see in epidemiologic studies. 14
Q. How so? 15
A. It is remarkable how consistent these animal studies are and how consistent they are with 16
findings in humans. I'm talking about attention, short term memory, hyperactivity, irritability. It 17
also allows us to some extent to see the effects on actual brain anatomy because we cannot 18
dissect the brains of children exposed to smoking in utero or in their homes. 19
Q. Has there been a focus on any agent? 20
A. Yes, there has been a focus on nicotine. So, nicotine is the best studied of the numerous 21
chemicals that one is exposed to by active smoking and by passive smoke. 22
Q. Why this focus on nicotine? 23
A. The literature has focused on nicotine because it is a well described behavioral teratogen, 24
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there is experience utilizing it, and because it is the best understood of all the chemicals
in 1
tobacco. In addition, it is the only one that is believed to be associated with the addictive
2
properties of individuals who are smokers and want to smoke but cannot bring themselves to 3
smoke. 4
Q. What is a behavioral teratogen? 5
A. A behavioral teratogen is something that a developing organism is exposed to that has
6
long term consequences in behavioral performance with or without evidence of physical 7
pathology. 8
Q. Are these consequences obvious to an observer? 9
A. Not always. Such types of behavioral alterations are not always observable to individual 10
observers for a number of discreet reasons. One reason is that they don't occur in all children 11
and so you can't say that there is a one on one effect and tell people that everyone who
has a 12
child who was exposed to tobacco smoke is going to have these problems. The other is that they 13
are very subtle and many require application of specific standardized tests which are expensive to 14
develop, and for many of the problems that we uncover, we don't really have therapeutic 15
implications or applications at this point. A third reason is that on a population basis,
subtle 16
problems which may or may not influence a particular child may have profound effects on a 17
population basis. 18
Q. Can you please provide an example of this? 19
A. That's been our overwhelming concern with lead poisoning for the past twenty years. 20
That is to say, if you are a doctor seeing children with blood lead levels from 10 to 30,
which we 21
know diminishes their function and has effects similar to those that nicotine causes, it
might 22

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seem modest to estimate a 5 or 6% loss for the individual child but it has huge effects when you 23
take a look at the 80 million children in America. 24

Q. What adverse neurocognitive effects are caused by this nicotine? 1
A. While we don't know the exact mechanism by which nicotine exerts its effect, animal 2
studies have shown that it accelerates the transition from the stage of brain development
that 3
primarily involves proliferation or increase in the number of brain cells, to the stage of 4
differentiation. 5
Q. Can you please explain this transformation? 6
A. The brain, like most organs, grows by dividing as a partially differentiated organ and
then 7
different parts of it take on specialized activities, or sizes, or shapes, or appearance. These
parts 8
have different functions and we know that nicotine shifts brain development from numbers to 9
early differentiation and this involves both the cholinergic nervous system and the adrenergic 10
nervous system. 11
Q. Is this a complicated process? 12
A. If this seems complicated, it is because the nervous system is categorized in a number
of 13
different ways often by the type of chemical that exists between the end of one cell and
the 14
beginning of another in that the release from the first cell leads to stimulation of the
second. So 15
in some it is adrenergic or sympathetic and in some it is cholinergic or parasympathetic
and in 16
some is dopamine which is the transmitter. 17
Q. What is dopamine? 18
A. Dopamine is one of the major neurotransmitters in the nervous system. It acts primarily 19
in two areas of the brain, the basal ganglia and the limbic system. In the basal ganglia, it
assists 20
in controlling voluntary movement. 21
Q. What are the basil ganglia? 22
A. The basil ganglia are the sections of the brain that function to help the individual with
23
controlling the speed and size of movements. They are also involved in the preparation of
the 24

brain and body for movement. In fact, dysfunction of the basil ganglia leads to both voluntary 1
and involuntary movement disorders. 2
Q. You also mentioned an effect on the limbic system? 3
A. Yes. In the limbic system, it helps to control emotional responses and memory. In the
4
periphery, it causes vasodilatation at low doses, but can cause vasoconstriction when 5
administered at high doses. Dopamine also stimulates the heart, causing increased cardiac

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6
output. 7
Q. What is the limbic system? 8
A. The limbic system is the area in the brain that plays a role in mediating the experience
of 9
emotions, visceral responses, and the storage of memories. The limbic system has connections 10
with most areas of the brain. 11
Q. How is dopamine affected by nicotine? 12
A. Nicotine stimulates dopamine’s release in the mesolimbic pathway, which leads to 13
increased locomotor activity. In rats, it has been shown to be a positive reinforcer of nicotine 14
self-administration—when rats were given nicotine, dopamine was released and the rates of 15
further self-administration of nicotine increased. 16
Q. Are there other ways that dopamine is affected by nicotine? 17
A. Yes. The dopamine system is influenced in a number of partially understood and 18
complicated ways by nicotine. Nicotine interacts with the dopamine and serotonin systems with 19
the following results: An increase in locomotor activity likely due to nicotine’s effects on
the 20
hippocampus; an increase in anxiety and impulsivity; an increase in adrenergic binding; attention 21
and memory deficits; a suppression of DNA synthesis; an alteration of levels of N-methyl-D- 22
aspartate receptors (NMDAR) in auditory cortex, which could be the cause for auditory-cognitive 23
processing defects found in children exposed to prenatal nicotine; a decrease in dopamine
24
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activity in ventral tegmental area, nucleus accumbens, striatum; and a decrease in serotonin 1
uptake. 2
Q. Earlier, you mentioned carbon monoxide as one of the smoke elements that plays a 3
role with neurocognitive impairments? 4
A. Yes, carbon monoxide is one of the smoking elements that play a role there. 5
Q. How does it play a role? 6
A. It is believed to be involved in one of the mechanisms by which smoking during 7
pregnancy results in lower birth weight and diminished head circumference. It inhibits the 8
release of oxygen into fetal tissues. 9
Q. How exactly does carbon monoxide cause these adverse effects? 10
A. At the most elementary level, carbon monoxide reduces the availability of oxygen to a
11
developing baby when that baby is in utero with a mother that is smoking. Smoking increases 12
carbon monoxide levels in the blood of the smoker and it crosses the placenta and it also
binds 13
with the hemoglobin of the baby. Carbon monoxide binds with hemoglobin more avidly than 14
does oxygen. 15
Q. What is hemoglobin? 16
A. Hemoglobin is the enzyme that requires multiple steps for its production that sits inside 17
of red blood cells, and carries oxygen to the tissues. 18
Q. What happens when the carbon monoxide binds with the hemoglobin? 19
A. When carbon monoxide binds with the hemoglobin in the mother, less oxygen is 20

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available for the baby. Carbon monoxide also transverses the placenta and binds to the baby's 21
hemoglobin even more avidly that it does to the mother's hemoglobin, making the hemoglobin 22
less available to bind oxygen and take that oxygen to the baby's tissues. Carbon monoxide 23
contributes to hypoxia, a decreased oxygen availability for the baby, which in turn also
turns on 24

the developing hematopoletic system of the baby to make more hemoglobin. 1
Q. What causes this increase in hemoglobin production? 2
A. The body responds with a whole host of environmental responses or enzyme responses. 3
When you block something that's a chain reaction, the body will increase production of things 4
before that chain reaction in an attempt to compensate. 5
Q. How was this determined to have occurred in babies? 6
A. Newborns whose mothers smoked during pregnancy have been found to possess higher 7
hematocrits, a measure of having made more hemoglobin. 8
Q. What neurobehavioral deficits are associated with this lack of oxygen (hypoxia)? 9
A. The associated deficits include inattention, repetition types of activities (memorization, 10
counting and sorting objects), hyperactivity, as well as increased distractibility and irritability, 11
and higher rates of occurrence for attention deficit hyperactivity disorder, and oppositional 12
defiance conduct types of disorders. 13
Q. What percentage of United States children are exposed to secondhand smoke? 14
A. 11.4 % of children are born to women who report smoking during pregnancy, 25-30% of 15
children live in households with smokers. 16
Q. Upon what evidence was this estimate based? 17
A. This evidence is based both upon self-reports of parents in national surveys, reports of
18
women to obstetricians that go onto children's birth certificates, and from estimates drawn from 19
the nationally representative National Health and Examination Survey, which the Centers for 20
Disease Control conducts. 21
Q. Is it possible that the exposure rate for United States children might be higher? 22
A. It is possible that children's exposures are higher than the average estimates that we 23
obtain by reports of adults because adults largely know that it is dangerous for parents
and others 24

to smoke around children and so in much of our human epidemiologic data there is probably 1
underreporting of smoking. Those that feel the worst about it probably hide it in those particular 2
studies, which only heighten the strength of those studies. The type of error it introduces
is that it 3
makes the findings of the published studies far more conservative. That's why the animal
studies 4
are so striking in that they so consistently demonstrate in animals' findings that we've

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found in 5
epidemiologic studies. 6
Q. What is the result of this misclassification and/or underestimation? 7
A. The result of this misclassification is an underestimation of the effects or the association 8
or the size of the association of exposure with untoward or undesired neurocognitive outcomes. 9
Q. If you know, are infants who are exposed to maternal smoking at risk for any other 10
toxic exposures? 11
A. I think that they are exposed at higher rates to higher amounts of lead and I am sure
that 12
they are exposed at higher rates to alcohol prenatally, and they are exposed to the toxic
effects of 13
maternal depression, anxiety, and a poorly educated mother. 14
Q. What do these multiple exposures mean for children? 15
A. These multiple exposures result in two things. For the research or for the legal 16
communities it introduces the issue of potential confounding. That is teasing apart the individual 17
effect of the tobacco from those things that go along with it. For the child, the public
health 18
community, the educational community and the health care community, it is one of 19
compounding, as opposed to confounding. That is, each of these have separate negative effects 20
on the child’s health and development and as I’ve noted before, they often have a multiplicative 21
effect and so they cumulatively lead to remarkable differences in disability rates and ability rates, 22
and all sorts of things necessary for health and success in adult life. 23
Q. How do you know this? 24

A. I know this as a consequence of researching this information, of writing and editing 1
information related to this, by reviewing this information for the purposes of this case, by
2
teaching it around the United States. 3
Q. Dr. Weitzman, can maternal smoking have an adverse effect on the infant's birth 4
weight? 5
A. Maternal smoking can have an adverse effect on infant birth weight. In fact, it is the
most 6
common cause of low birth weight and it has been estimated to account for about 70% of all low 7
birth weight cases in the United States. 8
Q. What are some of the other consequences? 9
A. Maternal smoking has enormous health care, educational, and quality of life 10
consequences for vast numbers of individuals with its contribution to children with medical 11
complications requiring intensive care in the nursery, to increased hospitalization rates, to
poor 12
school performance, as well as antisocial types of behavior. 13
Q. What is the actual impact? 14
A. There is a 5% reduction in weight per pack of cigarettes smoked per day with an average 15
decrease in weight of 150-300 grams. 16
Q. How much is that in pounds and ounces? 17
A. One pound equals 16 ounces, therefore it is a 0.33-0.66 pound reduction or a 5.3-10.6

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18
ounce reduction. 19
Q. So, two packs per day means a 10% decrease in weight? 20
A. Yes, it does. 21
Q. From where did this finding result? 22
A. In 1990, Kramer and colleagues discovered that the effect of prenatal maternal smoking 23
was a 5% reduction in weight per pack of cigarettes smoked per day. Furthermore, Meyer and 24
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Comstock reported that the effect of maternal cigarette smoking on infant birth weight caused an 1
average decrease in infant weight of 150-300 grams. 2
Q. When was this adverse effect first determined? 3
A. Low birth weight was identified as an adverse effect from prenatal smoking by Simpson 4
in 1957. 5
Q. Did subsequent studies confirm this association? 6
A. Literally hundreds and hundreds of subsequent studies have confirmed this association. I 7
know of no one in the medical or public health community who would earnestly raise any 8
questions about the causal nature of this relationship. 9
Q. Is this opinion widely held in the public health community? 10
A. Yes. 11
Q. Were any other adverse effects discovered by these studies? 12
A. Yes, the early studies also showed a diminished head circumference for children, a topic I 13
will discuss further in this testimony. 14
Q. Does this direct association still hold true today? 15
A. Yes. In fact, cigarette smoking is the single most important factor affecting birth weight 16
in developed countries. 17
Q. How exactly does prenatal maternal smoking cause a low birth weight in a fetus? 18
A. While we don’t know the exact mechanism of action, we do know that it affects the fetus 19
in several ways. First, as I’ve described before, it increases the carbon monoxide content
both 20
within the mother and child, inhibiting the ability of maternal and child hemoglobin to carry, and 21
ultimately deliver, oxygen to the child. Second, it increases vascular resistance in the
placenta, 22
which in itself decreases blood flow to the baby. 23
Q. How has this resistance been detected? 24

A. This effect has been detected by fetal ultrasound. 1
Q. What causes this resistance? 2
A. This increase in resistance is a result of a decrease in flow through the maternal-fetal 3
vessels. The flow is decreased due to the constriction of the uterine and umbilical arteries
(the 4
main source of mother’s oxygenated blood for the fetus) by nicotine. By Poiseuille’s Law, flow 5
is equal to the change in pressure multiplied by the radius to the fourth power divided by
the 6
blood viscosity and vessel length. 7
Flow = (Change in Pressure)(radius)4 / (viscosity)(vessel length) 8
Thus, if the radius is decreased by vascular constriction and all other factors remain

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constant, the 9
flow through that vessel decreases as well. Resistance is equal to pressure divided by flow 10
(Resistance = Pressure/Flow), so therefore if pressure is constant (the pressure of the mother's 11
blood is constant, unless she has an underlying heart or blood disorder) and flow decreases, 12
resistance must increase. This relationship is based off of Ohm's Law, and it is a fundamental 13
tenet of physics and vascular physiology. With decreased blood flow through these vessels, the 14
fetus receives less oxygen from the mother's blood, making it enter into a state of chronic
15
hypoxia, or low oxygen levels for a sustained period of time. 16
Q. Any other causes for this reduced oxygen delivery? 17
A. Decreased oxygen delivery to the fetus is also caused by increased levels of hemoglobin 18
bound to carbon monoxide (called carboxyhemoglobin), another effect of nicotine. The more 19
carboxyhemoglobin there is in the fetal circulation, the less oxygen that is delivered to
fetal 20
tissues. This state of chronic hypoxia has been documented to cause hypoxic-ischemic 21
encephalopathy, which is a cause of permanent damage to central nervous system cells. In 22
addition to chronic hypoxia's effects on the CNS, it can lead to cardiovascular, hematological, 23
gastrointestinal, pulmonary, adrenal, and metabolic effects. 24

Q. Any other effects? 1
A. There are a number of other alterations that have been identified, such as nitric oxide
and 2
prostacyclin deficiency, that are associated with maternal smoking and which in itself may affect 3
the uteroplacental blood flow and contribute to impaired fetal nutrition and increased perinatal 4
mortality of babies born to women who smoke. 5
Q. How does nitric oxide contribute to these conditions? 6
A. Nitric oxide is a substance that leads to vascular smooth muscle relaxation, thus acting
to 7
dilate blood vessels. 8
Q. What evidence do you have of this? 9
A. Studies as recent as July 2004 have demonstrated decreased nitric oxide levels and 10
decreased levels of endothelial nitric oxide synthase, the enzyme that synthesizes nitric
oxide, in 11
fetal umbilical blood in mothers who smoked during pregnancy. These levels were normal in 12
mothers who did not smoke during pregnancy. In 1991 and 1992, Myatt and colleagues 13
demonstrated that nitric oxide contributes to the resistance level in the fetal-placental
circulation. 14
Furthermore, throughout the 1990's, numerous studies have illustrated that nitric oxide and its 15
synthesizing enzyme endothelial nitric oxide synthetase, are decreased in women with 16
intrauterine growth retardation. In 1999, Obwegeser and colleagues demonstrated that maternal 17
cigarette smoking during pregnancy reduced nitric oxide in the fetal blood vessels. In

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2000, 18
Chalon et al. demonstrated that nicotine infusion leads to impaired endothelium-mediated
19
vascular relaxation in vivo. 20
Q. How do you explain this decrease? 21
A. This decrease can be explained by the fact that estrogen and L-arginine, which are
22
precursors of nitric oxide and endothelial nitric oxide synthase, are decreased in the maternal and 23
fetal circulation in mothers who smoke. These studies have also noted that these babies born to 24

smoking mothers who had low nitric oxide levels during gestation also suffered from low birth 1
weight and intrauterine growth retardation. 2
Q. Why is this important? 3
A. If nitric oxide is not present in sufficient levels to dilate the fetal blood vessels, the 4
vessels' formation may be impaired and they remain in a state of constriction. This constriction 5
limits the amount of blood, and thus the amount of oxygen and essential nutrients, that the fetus 6
receives. The effects of this were discussed in the last question. 7
Q. You also mentioned a deficiency in prostacyclin. What is this deficiency's impact on 8
fetal growth? 9
A. Prostacyclin deficiency, like nitric oxide, also contributes to constricting the fetal
vessels. 10
Prostacyclin is an inhibitor of platelet aggregation. If there is not sufficient prostacyclin
present 11
in the maternal-fetal circulation, platelets can aggregate, or clump, thus making the diameter of 12
the vessels smaller and decreasing flow and causing harm to the fetus. Chronic maternal 13
smoking is also associated with alterations of protein metabolism and enzyme activity in
fetal 14
cord blood. 15
Q. What do you rely on to support this conclusion? 16
A. A study in 2001 found significantly lower concentrations of several amino acids, 17
including aspartic acid, hydroxyproline, threonine, alanine, alpha-aminobutyric acid, methionine, 18
tyrosine, phenylalanine, and lysine, in fetal umbilical venous blood of smoking mothers 19
compared to nonsmokers. In addition, fetal umbilical plasma alkaline phosphatase was 20 decreased. 21
Q. How do these deficiencies adversely affect fetal growth? 22
A. These nutritional and biochemical deficiencies may contribute to fetal growth restriction 23
through fetal malnutrition. The chronic hypoxia discussed above may cause suppression of bone 24

matrix synthesis or placental synthesis. 1
Q. How is this shown? 2
A. This is reflected by low osteocalcin and bone alkaline phosphatase, which are enzymes 3
involved in bone formation and bone metabolism, further contributing to decreased fetal growth 4
when compared with nonsmoking mothers. 5
Q. Are there any other primary effects? 6

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A. Yes, there are. The effects I just discussed may be secondary to irreversible changes in
7
the cellular functions of the trophoblast which in itself may contribute to fetal growth
restriction. 8
Q. What is a trophoblast? 9
A. The trophoblast is the outer cell layer of the blastocyst. The blastocyst is the term for
the 10
human embryo at 6-9 days after conception, when the mass of dividing cells of the embryo form 11
into a fluid-filled cavity surrounded by cell layers. The trophoblast eventually becomes
the 12
placenta and the membranes surrounded the fetus. This layer forms into villi, which are finger- 13
like projections that facilitate the exchange of maternal and fetal blood. 14
Q. You also mentioned a condition called hypoxia. What is hypoxia? 15
A. Hypoxia refers to diminished availability of oxygen for utilization by the cells of the
16
body. When a mother smokes during pregnancy, there is decreased blood flow to the uterus, as 17
I've described, resulting in less oxygen being delivered to the baby. As I have already described 18
in this testimony, this reduction in oxygen delivery is compounded as I've already described by 19
the binding of hemoglobin in mothers' red blood cells with carbon monoxide, decreasing its 20
availability to transport oxygen to the baby and for the baby's blood to deliver or transport the 21
oxygen to the cellular level. 22
Q. What happens to the oxygen flow from the uterus to the placenta when a mother
23
smokes during pregnancy? 24

A. The evidence of hypoxia comes from animal studies and human studies showing 1
decreased oxygen being delivered to the placenta as well as from the fact that newborn babies 2
whose mothers smoked during pregnancy are born on average with higher hematocrits. 3
Q. What evidence is there to demonstrate that this hypoxia occurs? 4
A. Elevated hematocrit levels show this very clearly. Hematocrit quite simply is the percent 5
of whole blood that is made of cellular material. 6
Q. Are these effects of maternal smoking paralleled by any other birth situations? 7
A. Yes. Similarities have been noted between the birth characteristics of smoking mothers 8
and births that occur at high altitudes. 9
Q. What are these similarities? 10
A. Basically, small for gestational age babies and increased rates of low birth weight. At
11
high altitudes and in the fetuses of mothers who smoke, the oxygen saturation decreases.
12
Increased incidence of fetal growth restriction may reflect the limits of placenta and fetus
to 13
extract oxygen because of the altitude's effects on oxygen levels. A compromised placental-fetal 14
circulation could be unmasked at high altitude because of the effects of the low oxygen levels at 15

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these altitudes. As explained earlier, having a decreased amount of oxygen to deliver to
the fetal 16
tissues can lead to fetal growth restriction. Thus, the same chronic hypoxia occurs in fetuses of 17
mothers who smoke and mothers pregnant at high altitudes. 18
Q. When did the scientific community acquire all of this knowledge? 19
A. There was a scientific paper published in 1966 that discussed active smoking and 20
hypoxia. Also, the Surgeon General's Report cites a study from 1979, published by Davies and 21
colleagues, that noted that abstaining from smoking for 48 hours during the third trimester 22
increased available oxygen to the fetus by 8%. So, this knowledge has existed for some time. 23
Q. Besides actual problems at birth, are there any lasting effects on the subsequent 24

growth and development of children whose mothers smoked during pregnancy? 1
A. Yes, there are. Studies have shown that infants suffering from low birth weight are at
an 2
increased risk for emotional and behavioral problems. 3
Q. What are some of these problems? 4
A. The problems include lowered cognitive abilities, hyperactivity, and reading and math
5
disabilities. At least one study has also shown and increase in neurological soft signs which 6
means neurological abnormalities that cannot be tied to a particular brain problem but they are 7
noting that there's been some alteration to brain functioning and development. 8
Q. Any other consequences beyond low birth weight and emotional/behavioral 9
problems? 10
A. Small head circumference is another significant consequence. Your head circumference 11
at birth and the impact throughout childhood is determined by genetics and brain development. 12
Q. Why is a small head circumference significant? 13
A. Without brain development you get smaller heads so when you see a population with 14
smaller heads than another, you have to worry that there has been some damage to brain growth. 15
Q. What is the evidence? 16
A. There is animal model data showing that nicotine shifts brain cells from dividing, that
is 17
proliferation, and shifts them into the mode of differentiating, that is becoming different
types of 18
cells earlier than otherwise would be the case. 19
Q. Any other evidence? 20
A. A study by Matte and his colleagues, published in 2001, explored the relationship 21
between birth weight and measured intelligence at age 7. Their study examined 3,484 children in 22
the Collaborative Perinatal Project, a cohort study established to study the relationship
between 23
prenatal factors, labor and delivery, and child development through age 7. 24

Q. How was intelligence measured? 1
A. The children's intelligence was measured by the Wechsler intelligence scale for children. 2
Q. What did the study find? 3

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A. The study found that mean IQ increased with birth weight in both sexes across the full
4
range of birth weights (very low birth weight through normal birth weight). This relationship 5
was not due to confounding by any maternal or socioeconomic factors. 6
Q. Does the small head circumference endure for the children born to smoking 7
mothers? 8
A. Yes. 9
Q. For how long does this small head circumference last? 10
A. Research indicates that the differences in head circumference last until at least age 5 in
11
one study (Elwood et al, 1987), age 2 in another (Karatzaa, 2003) and age 1 in another (Ong et al, 12
2002). 13
Q. Is this wide range of ages a problem for you? 14
A. No. Despite great variation in studies, they all agree that it is clear that smoking for the
15
duration of the pregnancy causes a decrease in head circumference for at least one year after 16
birth. 17
Q. Does stopping smoking help in this case? 18
A. A 2000 study by Lindley, et al. reported that stopping smoking at the 32nd week 19
eliminated smoking-related differences in birth weight and head circumference, but not deficits 20
in crown-to-heel length. 21
Q. Dr. Weitzman, how has knowledge concerning the developmental consequences
of 22
children’s prenatal and early passive exposure to tobacco smoke been developed? 23
A. Over the past few decades, new data concerning these consequences has been developed 24

through a series of observational human subject studies using both cross-sectional and
1
longitudinal designs. In addition, these studies used samples that were diverse in terms of
2
ethnicity, culture and potentially confounding characteristics. 3
Q. What is a confounding characteristic? 4
A. Confounding characteristics are characteristics that are associated independently with
the 5
outcome that you are concerned about and the exposure of the child. 6
Q. Can you please provide an example? 7
A. For example, depressed women are more likely to smoke and that depressed women tend 8
to have children with increased rates of mental health and educational problems. So, maternal 9
depression is sometimes a confounder of smoking or smoking is a confounder of studies of 10
maternal depression’s effects on child development. 11
Q. Are you familiar with the epidemiological term "over controlling?" 12
A. I am familiar with over controlling. 13
Q. What is "over controlling?" 14
A. Over controlling is when you use statistical mechanisms and control for things that are
15
influences on the outcome of interest as well as confounders. 16
Q. How can overcontrolling affect smoking research? 17
A. With smoking, we know that nicotine is neurotoxic and a neuroteratogen itself and as a 18

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consequence leads to increased rates of behavior problems and intellectual problems. We also 19
know that smoking is the number one cause of low birth weight, accounting for 70% of low birth 20
weight and we know that low birth weight itself, causes many, many problems. So when you 21
control for low birth weight, what you are actually doing is being more conservative and
setting 22
the bar even higher because you are removing one of the ways in which tobacco actually 23
influences the child. So you are underestimating rather than overestimating the effect of
the 24
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tobacco which is both direct and via low birth weight. 1
Q. Earlier, you mentioned a cross-sectional study. What is such a study? 2
A. A cross-sectional study is one in which you obtain information about the outcome of 3
interest at the same time that you obtain information about the exposure. 4
Q. Can you please provide an example? 5
A. With the National Health and Nutrition Examination Survey, you can draw blood from 6
children participating in this study and get measures of cotinine, the major metabolite of
nicotine, 7
at the same time you study the child’s neurocognition or other outcomes, whether it is the
8
Metabolic Syndrome as I mentioned before, or tooth decay. 9
Q. What are the limitations of such a study? 10
A. A single cross-sectional study is limited in its ability to allow you to draw causal 11
inferences because you don’t have evidence that the exposure precedes the outcome. You don’t 12
necessarily have good evidence about the intensity of exposure over time. 13
Q. You also mentioned a longitudinal study. What is such a study? 14
A. A longitudinal study, in contrast to a cross-sectional study, is a study in which 15
information is collected about the exposure before the point of the outcome of interest. 16
Q. How would such a study work with the issue of maternal smoking and 17
neurocognitive deficits? 18
A. So if you enrolled pregnant women and followed them through the pregnancy and then 19
studied their children longitudinally, you would be able to demonstrate that tobacco exposure 20
occurred before the outcome of interest. That’s the major advantage of a longitudinal study over 21
a cross-sectional study. It obviously is much more expensive and takes logistically much
more 22
effort. 23
Q. Which type of study is used more by researchers? 24

A. Because of the difficulties and the amount of money that is required, researchers use 1
cross-sectional data more often than they do longitudinal data. 2
Q. In the end, what do these studies generally demonstrate? 3
A. The cross-sectional and longitudinal studies demonstrate the same sorts of findings: 4
exposure to tobacco smoke leads to increased rates of behavior problems at all ages, increased 5
rates of neurocognitive deficits and decrements in school performance. 6

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Q. With regard to the issue of the behavior of children with smoking mothers, what 7
have the studies performed over the years demonstrated? 8
A. As regards behavior, the studies have shown babies that are more negative, irritable,
and 9
fussy. These babies also cry more in the first year of life. In addition, they become toddlers who 10
are more difficult to discipline and more oppositionally defiant during the pre-school years, and 11
demonstrate increased rates of behavior problems of a wide range as well as increased rates of 12
ADHD during the school years. In these subjects' adolescence, there are increased rates of 13
conduct disorders and oppositional/anti-social types of behaviors. 14
Q. Did these studies account for any potential confounders? 15
A. Each of these studies attempted to control for potential confounders through use of a
16
multivariate statistical analysis. 17
Q. What is a multivariate statistical analysis? 18
A. A multivariate statistical analysis is a series of statistical procedures by which you are
19
able to separate out the independent association of one thing from another when you have
20
something that is as complicated as behavior problems, school performance or educational 21
achievement. 22
Q. How does it help to control for potential confounders? 23
A. Control for potential confounders enables one to use epidemiologic mechanisms to 24
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identify those characteristics that are independently associated with the outcome of interest. As 1
I've said many times, research is a word in the English language that means exactly what
it says – 2
you search and you search again. So no one study, whether it is an animal study or it is a
cross- 3
sectional or a longitudinal study convinces everybody that all potential confounders have
been 4
controlled for. It is the cumulative evidence used from multiple studies using different 5
mechanisms using different confounders that builds a body of evidence that leads reasonable 6
people to reach reasonable conclusions about the data. 7
Q. What are these potential confounders? 8
A. Some of the potential confounders are maternal mental health, maternal IQ, education,
9
poverty level, social supports, affect, low birth weight of the child, lead poisoning, iron
10
deficiency and anemia. 11
Q. Any specific examples of these studies? 12
A. Yes. Over the years, there have been at the very least 30 studies exploring cognitive
and 13
behavioral functioning in relationship to prenatal tobacco exposure. 14
Q. What have these studies discovered? 15

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A. In 1981, Nichols and Chen demonstrated a 1.28-times greater risk of increased locomotor 16
and impulsive behavior in children exposed to prenatal tobacco. Two years later in 1983,
17
Rantakallio and colleagues demonstrated a 1.78-times greater risk of delinquency in children 18
whose mothers smoked during pregnancy. In 1991 and 1993, Fergusson and colleagues
19
demonstrated increased conduct disorder, ADHD, and total disruptive behavior in these children 20
after adjusting for confounders. In 1994, McGee and Stanton demonstrated women who smoked 21
during pregnancy reported that their children had high rates of behavioral problems at 5
years of 22
age, even after statistical adjustment for a wide variety of confounding variables. In 1996,
23
Milberger and colleagues demonstrated a 2.7-times greater risk of ADHD in kids exposed to 24
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prenatal tobacco compared to those not exposed, and in 1997 Wakschlag and colleagues 1
demonstrated a 3.3-times greater risk of conduct disorder in children of mothers who smoked 2
during pregnancy. In 2003 and 2004, Fried and Watkinson were able to review data from 13- to 3
16-year-old children who had been exposed to tobacco during pregnancy. They showed that IQ 4
was linearly and negatively associated with in utero cigarette exposure, and these exposed 5
children showed decreased attention and increased impulsivity when compared to non-exposed 6
controls. 7
Q. Any other studies that you wish to discuss? 8
A. Yes. In the July 2003 edition of the Journal of Pediatrics, Robert Kahn and his 9
colleagues published a study examining the effects of a change in the dopamine transporter gene 10
in children and maternal smoking on childhood hyperactivity-impulsivity and inattentiveness. 11
Q. How did this study work? 12
A. The study followed 161 children from age 6 months to 5 years using standardized scales 13
of hyperactivity-impulsivity, inattentiveness and oppositional behavior. It determined if
the 14
specific change in the gene was present in zero, one or two copies in the children. 15
Q. What did the study find? 16
A. It determined that children who had two copies of this gene change and were exposed to 17
prenatal maternal smoking had significantly elevated hyperactive-impulsivity and oppositional 18
scores. 19
Q. Did you ever personally perform research in this area? 20
A. Yes. In 1992, a group led by myself noted that after statistical adjustment for 21
confounders, there was an increased rate of behavioral problems among children prenatally 22
exposed to tobacco. Evidence also suggested that there was a dose-response relationship present 23
as well. 24

Q. What is a dose response relationship? 1

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A. A dose response relationship means that with increased amounts, or doses, of a drug, 2
toxin, or exposure, there is increased presence or severity in the resulting disease process.
3
Q. Why is such a relationship significant? 4
A. The relationship is significant because it makes a stronger argument that a particular 5
exposure is involved in leading to a disease if increased rates of the disease are seen with
6
increased amounts of exposure. This occurred in my study, where we determined that the more 7
cigarettes that a mother smoked per day while pregnant, the higher the number of behavioral 8
problems that those children experienced. 9
Q. In summary, what does the animal model and human epidemiologic data 10
demonstrate with regard to the association between prenatal tobacco exposure and adverse 11
behavioral and neurocognitive effects on children? 12
A. The animal and human epidemiologic data are overwhelmingly consistent in 13
demonstrating an association between nicotine, prenatal tobacco and postnatal passive exposure 14
and neurocognitive functioning problems in, and increased rates of behavior and mental health 15
problems. 16
Q. Isn’t it true that differences between smoking and nonsmoking mothers, such as
17
increased illicit drug/alcohol use and more depressive symptoms among smoking mothers, 18
might explain the adverse outcomes experienced by the smoking mothers’ children?
19
A. No. That is incorrect. 20
Q. Why is that incorrect? 21
A. For two reasons. One is that the human epidemiologic studies have controlled for these 22
potential confounders; secondly, the experimental literature with animals which we could
never 23
conduct with humans clearly demonstrates that in the absence of illicit drugs, alcohol use,
or 24

depression, nicotine or tobacco smoke have adverse outcomes on children. 1
Q. So, this is a serious child health concern? 2
A. Yes. This is a very serious problem that warrants further extensive research, public
3
health action, and deliberation. There is, in my estimation, sufficient information to longer wait 4
to protect children from this. The problem is that tobacco is highly addictive and there are
forces 5
that act against the medical and public health communities that make it difficult to protect
all of 6
our children. 7
Q. Dr. Weitzman, turning your attention to the subject of secondhand smoke and otitis 8
media, will you please first explain the how the ear is built? 9
A. The part of ear that we can see and that most people think of as “the ear” is the outer
ear, 10
including the part you can put a Q-tip into. The middle ear is separated from the outer ear

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by the 11
tympanic membrane, which is also known as the eardrum. Inside the middle ear, a set of tiny 12
bones called ossicles connect the ear drum to the inner ear where the cochlea transforms
sound 13
waves into nerve impulses. The middle ear is open to the outside world via the Eustachian tube, 14
which connects down to the pharynx (the inside of the mouth). So, anything that the nose
and 15
mouth get exposed to, the middle ear is exposed to as well. 16
Q. What does the term "otitis media" mean? 17
A. Literally, otitis media means inflammation of the middle ear. There are many types of
18
otitis media but the main one we are concerned with is acute otitis media, or AOM, which
would 19
usually be referred to as an "ear ache" or "ear infection." 20
Q. How does otitis media develop? 21
A. When the middle ear is inflamed for any reason the walls of the Eustachian tube become 22
swollen and thus become narrower and often blocked. When the Eustachian tube is blocked, 23
fluid can collect in the middle ear, and sometimes become infected. In the same way that
24

stagnant water becomes a breeding ground for bugs, whereas flowing water does not, blocked 1
fluid in the middle ear is a good growth medium for bacteria. So, when children are exposed to 2
something that irritates the nose and throat, they are at risk of developing middle ear infections. 3
Q. What symptoms will generally accompany acute otitis media? 4
A. Otitis media will be evidenced by ear pain, fever, irritability, and poor hearing. 5
Q. How would a doctor diagnose acute otitis media? 6
A. Acute otitis media is evidenced by abnormal findings on examination of the ear, 7
including a red ear drum bulging with entrapped pus. The most common way of detecting this is 8
to use an otoscope, which is a specialized lighted magnifier designed for examining ear drums. 9
Q. Is otitis media especially prevalent in any one age group? 10
A. Yes, otitis media is particularly common in young children. 11
Q. Can you explain why children are particularly susceptible to otitis media? 12
A. Because of the smaller size of all their anatomical structures, it is easier for the 13
Eustachian tube to get blocked. Also young children may be more susceptible to various 14
infections because of an immature immune system. 15
Q: Dr. Weitzman, do children get otitis media more frequently than adults do? 16
A: Yes. 17
Q: Other than what you have already explained, are there any additional reasons 18
children get otitis media more frequently than adults? 19
A: Yes, the Eustachian tube is shorter and has a more horizontal orientation in young 20
children, so it is less likely to open. Therefore, fluid collects more often within the middle
ear 21
space of young children. With age and growth, this tube becomes more vertical, thus allowing 22
for better drainage of the middle ear through the nasal structures. In addition, young

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children 23
spend more time in a horizontal position, thus influencing proper drainage of the middle
ear. 24

Q. How common is otitis media? 1
A. Acute otitis media is the most frequently diagnosed ailment, the most common bacterial 2
infection, and the most common single reason for antibiotic therapy in children. 3
Q. Can you estimate for the Court how many children each year in the United States 4
will have otitis media? 5
A. Each year, there are over 24 million office visits for otitis media in children under 15.
6
Q. Dr. Weitzman, what are the general ramifications for children and their parents 7
upon a diagnosis of otitis media? 8
A. In general, children who are diagnosed with otitis media will be prescribed antibiotics
and 9
will miss some day care or school, meaning that their parents will miss some work. Most of 10
them will get better without any serious consequences. Rarely, however, acute otitis media can 11
lead to mastoiditis and meningitis. 12
Q. Do the antibiotics used to treat otitis media have side effects associated with them? 13
A. Yes. Some children will have side effects from the medications and occasionally these
14
will be serious. 15
Q. What are the side effects of these antibiotics? 16
A. Many children will get non-allergic rashes with antibiotics; these are generally not 17
dangerous but can be concerning to parents. Allergic reactions to antibiotics, although rare, can 18
be life-threatening. Antibiotics frequently can cause diarrhea, which can then be a separate 19
problem. At a population level, overuse of antibiotics leads to increased prevalence of antibiotic- 20
resistant germs, which then can’t be treated if they cause serious infections. 21
Q. What is "recurrent acute otitis media"? 22
A. Recurrent acute otitis media refers to the occurrence of three or more episodes of acute
23
otitis media in six months or four episodes in one year. 24

Q. Is recurrent acute otitis media common in children? 1
A. Yes, several studies indicate that recurrent acute otitis media occurs during the first 2
several years of life in approximately 20 to 30% of the pediatric population. 3
Q. How is acute otitis media treated? 4
A. The standard treatment now in this country is a course of oral antibiotics, like amoxicillin. 5
In the days before antibiotics, the treatment was to poke a hole in the ear drum to drain
the pus 6
(tympanocentesis). This technique is still performed by some. Another option is to treat
the 7
symptoms with pain relievers like Tylenol or Advil and only use the antibiotics if the infection 8

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fails to heal on its own. 9
Q. Dr. Weitzman, other than acute otitis media, are there any other kinds of otitis 10
media? 11
A. Yes, there is also a condition known as "otitis media with effusion." 12
Q. What is "otitis media with effusion"? 13
A. This is sometimes called "serious otitis media," or "glue ear," and is a form of persistent 14
middle ear disease, involving non-purulent fluid behind the ear drum, generally in the absence of 15
fever or ear pain. Children with this condition have a layer of fluid in the middle ear for
months 16
on end, like a sink with a very slow drain that always has water in it. This “water in the
ear” can 17
act like an ear plug and impair hearing. 18
Q. How is this type of otitis media treated? 19
A. It is often treated by an ear-tube insertion (tympanostomy). 20
Q. Is this a common procedure? 21
A. Yes. Tympanostomies are the most common surgical procedures carried out on children 22
in industrialized countries. 23
Q. Could you please describe how the procedure is done? 24
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A. It involves inserting a tiny plastic tube through the ear drum. This tube opens the middle 1
ear up to the outside world via the ear canal and helps to keep the middle ear from getting
filled 2
with fluid. One of the ways it does this is by equalizing pressure between the middle ear
and the 3
outside world. Otherwise, with a blocked Eustachian tube, a relative vacuum can form in the 4
middle ear and this will tend to suck mucus into the middle ear. 5
Q. Are there any side-effects caused by this procedure? 6
A. Generally, the tubes will come out on their own after months or years, but occasionally 7
they get stuck and an additional procedure is needed to remove them. Sometimes a granuloma 8
can develop at the site of insertion and this can lead to bleeding out of the ear canal. 9
Q. Are there risks associated with this procedure? 10
A. Yes. It is a surgical procedure requiring anesthesia, and there are always risks associated 11
with anesthesia. 12
Q. What considerations might a doctor take into account when deciding whether ear 13
tube insertion is warranted for a particular patient? 14
A. Tube placement can be considered in the management of recurrent acute otitis media, 15
especially when acute otitis media complicates otitis media with effusion and is accompanied by 16
hearing loss or speech delay. 17
Q. How successful is ear tube insertion in alleviating the occurrence of otitis media? 18
A. The procedure does not have a 100% success rate, but acute otitis media does tend to 19
occur less frequently in children who have had ear tubes placed. 20
Q. Dr. Weitzman, turning now from the symptoms and treatment of otitis media to 21
epidemiologic information regarding otitis media, is there epidemiologic data that

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suggests 22
a connection between secondhand smoke and otitis media? 23
A. Yes--there is epidemiologic data, which has been reviewed several times by federal 24
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agencies, that suggests this connection. 1
Q. What is the current conclusion regarding the import of this information? 2
A. The conclusion is that there is a relationship between secondhand smoke exposure in the 3
home and either acute otitis media or otitis media with effusion, particularly among children 4
under 2 years of age. 5
Q. You mentioned that federal agencies reviewed this information. Which federal 6
agencies were you referring to? 7
A. The Surgeon General reviewed the data in 1986, the National Research Council (NRC) 8
also reviewed it in 1986, the US Environmental Protection Agency reviewed it in 1992, and the 9
National Cancer Institute/California Environmental Protection Agency reviewed it in both 1997 10
and 1999. The different reports all included a review of the data available to date at the
times 11
they were written; and they all reached similar conclusions. 12
Q. How did the agencies review the data? 13
A. For example, the NCI report reviewed the previous government reports and updated them 14
with additional information. They included in their review the data from the previously 15
published reports as well as added reviews of newer research studies that had been published 16
since the previous reports were written. 17
Q. What type of additional information was included in the NCI report? 18
A. The NCI/EPA report was also very thorough, systematically reviewing many different 19
papers and providing a table with information on the scientific strengths and weaknesses
of the 20
various individual studies, rather than just a list with a concluding summary. 21
Q. Have studies about the link between otitis media and second hand smoke been 22
published in peer reviewed journals? 23
A. Yes. In 1998 a systematic quantitative review of 34 papers was published. 24
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Q. What is a systematic review? 1
A. A systematic review is the application of strategies that limit bias in the assembly,
critical 2
appraisal and synthesis of all relevant studies on a specific topic. Systematic reviews focus on 3
peer-reviewed publications about a specific health problem and use rigorous, standardized 4
methods for selecting and assessing articles. A systematic review differs from a meta-analysis in 5
that it does not include a quantitative summary of the results. 6
Q. Dr. Weitzman, turning your attention to this review, what were the subjects of the 7
papers reviewed? 8
A. The papers reviewed included 11 papers on otitis media, 9 on recurrent acute otitis media, 9
5 on middle ear effusion, and 9 on surgery for otitis media with effusion. 10
Q. And who are the authors of this systematic review? 11
A. David P. Strachan and Derek G. Cook from London. 12
Q. How would you characterize the import of these studies reviewed in this paper?

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13
A. Epidemiologic methods were used to investigate whether secondhand smoke is associated 14
with otitis media, and the overall results of these studies support the hypothesis that secondhand 15
smoke causes otitis media. 16
Q. How did the authors analyze the studies they reviewed? 17
A. Quantitative meta-analysis was performed for all the outcomes except for acute otitis
18
media. 19
Q. What is a meta-analysis in this context? 20
A. Meta-analysis is a statistical synthesis of the data from comparable studies leading to a
21
quantitative summary of the pooled results. 22
Q. Why was acute otitis media excluded from the meta-analysis? 23
A. Acute otitis media was excluded because the studies were too varied in design for 24

meaningful synthesis. Meta-analysis doesn’t work if you mix apples and oranges together, so a 1
good deal of judgment is needed in order to apply it properly. Some studies were cohort,
others 2
cross-sectional; definitions of exposure and disease varied. 3
Q. Does this affect your conclusions about acute otitis media? 4
A. This does not affect my conclusions about otitis media, or the strength of the evidence
5
about its relationship to passive smoking. It just means that one technique for summarizing the 6
evidence was not used for this one outcome in this one paper. 7
Q. What did Strachan and Cook conclude? 8
A. The authors concluded that: "[e]vidence for middle ear disease is remarkably consistent, 9
with pooled odds ratios if either parent smoked of 1.48 (1.08-2.04) for recurrent otitis
media, 10
1.38 (1.23-1.55) for middle ear effusion, and 1.21 (.95-1.53) for referral for glue ear.
Odds for 11
acute otitis media are in the range 1.0 to 1.6. [….] Evidence from different study designs
and for 12
different disease outcomes relating to middle ear disease in young children is remarkably
13
consistent in suggesting a modest increase in the risk associated with parental smoking. A
14
pooled odds ratio of the order of 1.2-1.5 reasonably summarizes the effect of either parent
15
smoking on the incidence and recurrence of acute otitis media and the prevalence of middle ear 16
effusion, determined by tympanometry or otoscopy. There is also some evidence that parental 17
smoking adversely affects the long-tem prognosis of untreated glue ear.” 18
Q. Dr. Weitzman, I'd like to ask you to explain some of the terms you have used in
19
discussing the findings of studies–first, what are pooled odds ratios? 20
A. The odds ratio is related to the risk of acute otitis media associated with tobacco smoke 21

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exposure. An odds ratio of 1 would mean no increased risk. Greater than one means increased 22
risk, less than one means decreased risk. The pooled odds ratio is derived by taking the
data 23
from the various studies reviewed and combining them as if they were from one big study. This 24

is useful when one finds multiple studies, none of which is powerful enough by itself to 1
demonstrate statistically significant odds ratios. Combining the data from the small studies 2
together as if they constituted one big study will sometimes allow one to find a statistically 3
significant aggregate odds ratio. This aggregate odds ratio is the pooled odds ration. 4
Q. What is selection bias? 5
A. Selection bias is error due to systematic differences between those who take part in a 6
study and those who do not. For example, one of the studies we reviewed includes only children 7
who never had an ear infection, so this is a group that is not representative of the general
8
population because ear infections are very common. If present, selection bias invalidates
9
conclusions and generalizations that might otherwise be drawn. 10
Q. What is information bias? 11
A. Information bias is a flaw in measuring exposure or outcome data that results in 12
differences in the accuracy of information collected between comparison groups. For example, if 13
children exposed to tobacco smoke go to the doctor more often in general for any reason,
then 14
they would be more likely to get diagnosed with acute otitis media simply because their ears are 15
seen by doctors more often. 16
Q. How are the biases you have mentioned best addressed? 17
A. The best studies reviewed overcame this bias by having standardized follow-up for ear
18
exams in both study groups. 19
Q. How does this overcome the biases? 20
A. For example, if you have a cohort study, where you are following children from the time 21
of birth, and some are exposed to tobacco and some aren’t, but they all get their ears checked in 22
the same way by the same people at the same ages, and they all have their exposure to smoking 23
measured in the same way, then you won’t have information bias. If overall the children in both 24

groups of the study are generally representative of the population they are part of (with
respect to 1
age, sex, medical history, etc.) then you won’t have selection bias. 2
Q. What are confounding factors? 3
A. Confounding factors, also known as confounding variables, are those factors that are 4
independently associated both with the likelihood of experiencing an exposure, and the outcome 5
of interest. A confounder cannot be an intermediate variable on the causal pathway

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between the 6
exposure (i.e. tobacco smoke) and the outcome (ear infections). 7
Q. Did any study you have referred to simultaneously address selection bias, 8
information bias and consider confounding factors? 9
A. No. 10
Q. How does that affect the credibility of the results? 11
A. Even though no single study was perfect, the various studies reviewed complemented one 12
another's shortcomings by addressing different types of bias. Strachan and Cook concluded that 13
where these [biases] have been investigated or excluded in the design or analysis, the 14
associations with parental smoking persist." 15
Q. Dr. Weitzman, can you please explain this conclusion? 16
A. It means that even if there is a study where, for example, information bias is a problem, 17
one can't argue based just on that, that all of these studies are invalid. Most of the studies
were 18
designed to exclude that particular kind of bias and they still found an association between 19
passive smoking and middle ear disease. So that would suggest that the association in the
one 20
study was not just a result of the information bias, because if that were the case, there
should be 21
no association in studies without such bias. And the same line of argument goes for the other 22
types of bias. 23
Q. What were the main recommendations of Strachan and Cook? 24

A. The authors recommended that future studies obtain more objective information about the 1
duration and intensity of exposure to environmental tobacco smoke, including specifically the 2
distinction between prenatal and postnatal exposure. They also recommended objective 3
measurement of exposure with cotinine or other biomarkers. Elsewhere, they have called for 4
experimental studies demonstrating the effect of reducing exposure, although they noted that a 5
useful randomized clinical trial on this topic would require approximately 33,000 children and so 6
it is unlikely that this will ever take place. 7
Q. Dr. Weitzman, I'm going to ask you to go back and explain parts of your answer to 8
the previous question. First, what benefit would objective measurement of exposure 9
provide? 10
A. People tend to lie about embarrassing behaviors when they fill out questionnaires. It is
11
documented specifically that women tend to lie about smoking during pregnancy (i.e. they'll tend 12
to deny being smokers when they actually are). If many of the smokers are labeled in the
study 13
as non-smokers, then this will lead to "misclassification bias" and will produce erroneous
results. 14
Q. Dr. Weitzman, what is cotinine? 15
A. Cotinine is a metabolite of nicotine. That is to say that if your body absorbs any nicotine 16

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it needs to eliminate it and one of the byproducts of this chemical breakdown is cotinine,
which 17
is then expelled from the system in the urine, but can also be found in the hair or in the
blood. So 18
taking hair samples, and measuring the chemical content of cotinine allows one to assess
19
exposure to tobacco. 20
Q. How is hair cotinine measured? 21
A. Strands of hair are obtained from the scalp, and then taken to a laboratory where they
are 22
washed, dried, weighed, dissolved in chemicals and analyzed by a technique that can quantitate 23
cotinine, radio immunoassay for example. This is not a standard test that can be done in
every 24

medical lab. 1
Q. What are biomarkers? 2
A. Biomarker is an abbreviation of “biological marker” and is defined as “a cellular or 3
molecular indicator of exposure, health effects or susceptibility.” In this case, cotinine is
a 4
molecular indicator of exposure. The use of biomarkers in this way is sometimes called 5
“molecular epidemiology.” 6
Q. Why are the recommendations of Strachan and Cook of particular importance? 7
A. First of all, distinction between prenatal and postnatal exposure is important--because
in 8
utero damage is likely on the causal pathway between maternal smoking and otitis media, low 9
birth weight is not a potential confounder of the relationship of secondhand smoke with otitis 10
media, but rather is an additional outcome of secondhand smoke, and thus not something to 11
control for. 12
Q. What is the concern regarding controlling for factors that are likely on the causal 13
pathway between maternal smoking and otitis media? 14
A. Controlling for factors on the causal pathway will artificially reduce the observed relative 15
risk. This issue is particularly relevant in light of the Stathis study, which did distinguish
16
between prenatal and postnatal exposure, and found that prenatal smoking is more important than 17
postnatal smoking with respect to otitis media risk. Studies that lump together prenatal
and 18
postnatal smoking (especially if they “control for” low birth weight and other manifestations of 19
prenatal smoking) are therefore likely to miss a real effect of maternal smoking. 20
Q. Are there any other reasons that those authors strongly recommended objective 21
analysis? 22
A. Yes. Objective measurement of exposure with cotinine or other biomarkers is preferable 23

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because of the stigma associated with smoking during pregnancy. It is more likely that smokers 24

would be misclassified as non-smokers than the converse, causing a bias in the studies toward 1
finding a smaller risk from smoking. Additionally, many women stop smoking temporarily 2
during pregnancy, however, if that is the critical period for causing the damage that leads
to ear 3
problems, then one’s current smoking pattern at 1 year or 5 years will not be a good marker for 4
relevant exposure, so studies that only use smoking after birth as a measure of exposure
will also 5
find misleading results. 6
Q. Are there any other ways that these experiments could be handled? 7
A. Yes. The proper way to study this problem and to help find a solution would be through a 8
trial of exposure reduction. However, the strongest evidence would come from controlled 9
experiments which would be unethical in this case because it would call for exposing children to 10
a poison like tobacco smoke. 11
Q. Can you describe the materials you reviewed in order to draft the report you 12
submitted in this litigation? 13
A. Yes. For my expert report, I did a new review of literature, searching Medline from 1997 14
to June 2001, using the search terms: tobacco smoke pollution and otitis media. The search 15
terms for text words were: passive, second hand, involuntary, parent, maternal, mother, paternal, 16
father, household, smoke, tobacco, cigarette, tympanostomy, otitis media, middle ear, or
glue ear. 17
I also restricted the age range to 0-18 and only reviewed English language articles. 18
Q. Can you explain what the Medline database is? 19
A. Medline is an online computerized database indexing almost all the peer-reviewed 20
medical science in the world. It is based on data compiled by the National Library of Medicine. 21
It is continuously updated and can be searched by topic, key word etc. A specific list of
topics 22
constitutes the MeSH or medical Subject Headings. For example, the official MeSH for passive 23
smoking or ETS is “tobacco smoke pollution.” 24

Q. Did you review any materials besides those found in the Medline searches? 1
A. Yes, I also reviewed relevant citations found in the articles within my search, which
had 2
not been previously reviewed. 3
Q. How many articles did your searches produce? 4
A. My searches turned up 20 articles, however 6 of those I deemed irrelevant for providing 5
evidence about secondhand smoke and otitis media. Hence I focused on the 14 relevant 6
epidemiological studies not included in previous reports. 7
Q. What did these epidemiological studies demonstrate regarding a link between 8
secondhand smoke and otitis media? 9
A. Three of the 14 studies had a strong design for investigating the secondhand smoke-otitis 10
media association. 11
Q. In your opinion, Dr. Weitzman, what are the studies that best evaluated the link

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between secondhand smoke and otitis media? A. The Stathis study from 1999, the Adair-Bischoff study from 1998, and the Ilicali study from 2001 are the studies that best evaluated this link. Q. What were the "strong designs" you referred to for these studies? A. The different studies had different elements of strong design and I could discuss those individually. The Stathis study's strong design is in its prospective nature and its high subject number. The investigators enrolled 8,556 at the first prenatal visit and followed them and their children through five years post-delivery to note which children developed middle ear disease and its association with smoking status of the mother during and after pregnancy. Further strengthening this study is its ability to adjust for confounding variables. The Adair-Bischoff study was a case-control design, and identified children as cases for otitis media or controls having very low incidence of otitis media. Parents were interviewed by telephone for various

smoking exposures in addition to confounding variables. Further strengthening this study is the fact that 15% of the sample was chosen at random to have hair cotinine measurements, home visits, and physician medical record assessment to strengthen parental interviews. The Ilicali study was also a case-control design, and tobacco exposure was measured using objective urinary continine analysis, in addition to questionnaire and physical examination. The use of objective continine measurements in the latter two studies strengthens their design. Q. You have used the term "relative risk." What does this term refer to? A. Relative risk is often known as "risk ratio," which is the ratio of the risk of disease in the exposed to the risk among the unexposed." The higher the relative risk, the greater the likelihood that the exposure is causally related to the disease. Q. What were the relative risks found in these three studies you have described? A. These three studies found relative risks ranging from 1.9 to 3.9. These are higher than those reported in previous reviews. Q. Can you generally describe the Adair-Bischoff study? A. The Adair-Bischoff study was a case-control study which was comprised of a population-based probability sample in Canada. The results were determined through logistic regression. Q. What was the study's focus? A. The study aimed to determine if there is an association between environmental tobacco smoke and otitis media in pre school aged children. Q. What is a case-control study? A. A case control study is "the observational epidemiologic study of persons with the

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disease 21
of interest and a suitable comparison group of persons without the disease.” Controls are
those 22
persons who resemble the ‘cases’ in such respects as age and sex but do not have the disease of 23
interest. 24
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Q. What was the design of the Adair-Bischoff study? 1
A. The study by Adair-Bischoff employed hair cotinine measurements, home visits, and 2
inspection of physician medical records on a subset of the participants to validate the exposure 3
and outcome information otherwise obtained by telephone interview; they also controlled for a 4
large number of potential confounders in their analysis. 5
Q. How did Adair-Bischoff study assess exposures to secondhand smoke? 6
A. To assess exposures, the study involved questioning parents regarding the number of 7
household smokers during the child’s first three years of life. The study also noted the
number of 8
cigarettes smoked by parents and other household members. 9
Q. How did the study address outcomes? 10
A. For outcomes, the researchers asked about ear infections, including recurrent acute otitis 11
media, otitis media with effusion, ear-tube insertion, and use of antibiotics to prevent
recurrent 12
acute otitis media. In the end, the study used hair cotinine measurements, home visits, and 13
inspection of physician medical records on a subset of the participants to validate the exposure 14
and outcome information otherwise obtained by telephone interview. 15
Q. What does the word “confounder” mean in this context? 16
A. A confounding factor has been defined as a variable that can cause the outcome of 17
interest, is not an intermediate variable, and is associated with the factor under investigation. In 18
this study for example, if crowding and passive smoking are both risk factors for ear infections, 19
crowding may be a confounder, because crowding and smoking tend to go together since both are 20
related to poverty. So if one found an association between passive smoking and otitis, somebody 21
could argue that the smoking is just a marker for crowding and that crowding is the real
cause. 22
To take care of this kind of problem, the researchers would control for potential confounders. 23
Q. Dr. Weitzman, what does it mean for a study to control for confounders? 24

A. To control for confounders means “to adjust for or to take into account extraneous 1
influences in order to reduce confounding bias.” These statistical adjustments can get 2
complicated but the basic concept is very simple, and comes down to comparing apples to apple 3
and oranges to oranges. If we go back to the example we just mentioned, with smoking and 4
crowding, one would check that one weren’t comparing children in homes with a lot of smoke 5
and a lot of crowding with homes with no smoke and no crowding; one would want the smoking 6
prevalence different but the level of crowding to be the same. If the level of crowding is

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the 7
same in both groups, but smoking is still associated with more otitis, then the crowding
doesn’t 8
explain the differences in otitis associated with smoking. 9
Q. What were the potential confounders that Adair-Bischoff study controlled for? 10
A. The study controlled for: age, sex, low birth weight, pre-term birth, history of allergies, 11
history of asthma, upper respiratory tract infection, lower respiratory tract infection,
health care 12
use, general health status, family history of respiratory illness, child care, prenatal care,
parents' 13
education, income, home ownership, crowding, type of heating, humidity, pets, and chemicals. 14
Q. Can you summarize the authors’ quantitative findings? 15
A. Yes. The authors found that “[f]or children living in households with two or more 16
smokers, the odds of middle ear disease were 1.88 (1.12-3.15) compared to controls. Then, they 17
used the number of cigarettes smoked as the exposure measure (10+ vs. fewer) yielded a similar 18
OR of 1.89. 19
Q. Were these results significant? 20
A. Yes, these results were statistically significant and indicated that passive smoking 21
approximately doubles the risk of otitis media. 22
Q. Can you summarize the authors' conclusions based on those statistical findings? 23
A. Yes. The authors concluded that environmental tobacco smoke is an important risk factor 24

for middle ear disease in urban pre-school children, even in a relatively affluent population. 1
Q. In your opinion, Dr. Weitzman, was this a well-implemented study? 2
A. I believe this was a very important study which used good methodology. It is important 3
to obtain objective information measuring exposure. However, most of the studies don’t do that 4
because it is so difficult and expensive. These researchers compromised and came up with the 5
alternative solution of using a 15% subset of the study population to validate the questionnaire 6
results using home visits and hair cotinine as an objective biomarker of exposure. They also 7
double-checked the accuracy of reports about outcomes by reviewing the subjects’ medical charts 8
and they found good concordance in this validation study between the different types of 9
measures. 10
Q. Did they control for potential confounders? 11
A. Yes. They controlled for a large number of potential confounders. In fact, they may have 12
over controlled by including allergy and asthma since environmental tobacco smoke is long- 13
established as a risk factor for allergy and asthma symptoms. Ironically, that would lead
to an 14
underestimate of the environmental tobacco smoke effect. 15
Q. Dr. Weitzman, in your opinion is this study still good science? 16
A. Yes, since the overcontrolling would lead to an underestimate of the odds ratio, this 17

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makes the study’s conclusions that much more cautious and believable 18
Q. How was this study received by the scientific community? 19
A. It was well-received. It was published by the Archives of Pediatrics and Adolescent 20
Medicine, which is the official pediatric journal of the American Medical Association. It
has not 21
been refuted by subsequent work. 22
Q. Dr. Weitzman, will you generally describe the Ilicali study? 23
A. The Ilicali study was a case-control study designed to determine the effects of passive
24

smoking on otitis media with effusion and recurrent acute otitis media. 1
Q. Specifically, what was the design of the Ilicali study? 2
A. The Ilicali study, published in 2001, included children aged three to eight years in Turkey. 3
The study employed an objective definition of both exposure and outcome, with environmental 4
tobacco smoke measurement by urine cotinine and otitis media assessment by direct examination 5
by an ear, nose and throat specialist. 6
Q. Did the study control for potential confounders? 7
A. Yes, the study controlled for: the number of persons residing in the same household, sex, 8
age of home, type of home, and wood burning stove. 9
Q. What were the authors' quantitative conclusions? 10
A. Children with elevated urine cotinine levels were more likely to have otitis media. 11
Q. What OR did they find? 12
A. The OR was 2.29 (1,08-4,85) In other words, passive smoking more than doubled the 13
risk of middle ear disease. 14
Q. Dr. Weitzman, in your opinion, was this a well-implemented study? 15
A. The study yielded very strong evidence because it used objective 16
measures of exposure and outcome. 17
Q. Would have you have any criticisms about this study? 18
A. Yes. One problem is that the children involved in the study were those who had received 19
ventilation tubes because of recalcitrant otitis media with effusion or recurrent acute otitis
media. 20
Therefore, one doesn't really know how bad the otitis media is in the control group, except that it 21
is not bad enough to have required such tubes, so the control group likely contains cases
of otitis 22
media with effusion and acute otitis media. In addition, they used a relatively high cut-off
for 23
urine cotinine to define exposure (25 vs. 10 ng/mg) so the “unexposed “group likely contains 24

many exposed children. 1
Q. What is the effect of these features? 2
A. These features would both lead to an underestimate of the environmental tobacco smoke 3
effect. 4
Q. Dr. Weitzman, in your opinion, is this study still considered good science? 5
A. Yes, as with the previous study, when one finds biases that are in the direction of 6
reducing the odds that is considered to be conservative or cautious, rather than cavalier or

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speculative and is a good sign that the authors are not going out of their way to exaggerate an association that isn't really there.

Q. Was the study accepted by the scientific community?

A. Yes, it was published in Laryngoscope, which is the journal of the American Laryngological, Rhinological and Otological [i.e. ENT] Society, and it has not been refuted.

Q. Can you describe the Stathis study?

A. The Stathis study was a prospective cohort study which enrolled women and followed them during their pregnancy, at birth, at six months, and five years post-delivery. Logistic regression analysis was then used to analyze the data while controlling for multiple factors. The study found an association between exposure to tobacco smoke in utero and increased risk of middle ear disease in children.

Q. What is a prospective cohort study?

A. A prospective cohort study is one in which a defined population is selected and followed forward for a period of time. From this single population, it is noted which subjects are exposed to the risk factor being studied and which subjects were not exposed. These two groups are then followed forward in time to compare the incidence of the development of the outcome disease in the exposed and non-exposed groups. The main feature of a cohort study is the observation of a

large number of people over a long period with comparison of incidence rates in groups that differ in exposure levels (the two groups are the "cohorts"). Cohort studies are generally prospective, i.e. they start before the disease has occurred and then go forward in time. This is different from case-control studies which start with the disease occurrence (cases) and then ask about preceding exposures. The terms "prospective study" and "cohort study" are often used interchangeably. So, according to some people, "prospective cohort" is redundant.

Q. What is the Stathis study's design?

A. Stathis and the other researchers studied a large number (7357) of children recruited before birth. They then distinguished prenatal from postnatal smoking while controlling for numerous potential confounders.

Q. Did they control for low birth weight?

A. They did not control for low birth weight or pre-term birth as some other studies did, and that is a strength of the study.

Q. Why is it a strength of the study that they did not control for low birth weight or pre-term birth?

A. Because in utero damage is likely on the causal pathway between maternal smoking and otitis media, low birth weight is not a potential confounder of the relationship of environmental

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tobacco smoke with otitis media, but rather is an additional outcome of passive smoking,
and 18
thus not something that requires being controlled for. Controlling for factors on the causal
19
pathway will artificially reduce the observed relative risk. 20
Q. What potential confounders did the Stathis study control for? 21
A. The study controlled for: child's age and gender, maternal age, maternal education and
22
socioeconomic status, breastfeeding history, maternal employment status, marital status,
history 23
of day care use, and number of siblings children in the household. 24

Q. Can you please explain what a logistic regression analysis is? 1
A. Regression analysis involves finding the best mathematical model to predict y from the 2
x's (where y is the disease outcome and the x's are all the potential risk factors). In 3
epidemiology, the logistic model of regression is commonly used; this is a specific statistics 4
technique. 5
Q. How does logistic regression analysis provide information for investigators doing 6
work like what you have described? 7
A. This is the mathematical technique that allows one to control for multiple factors at
once 8
and obtain an "adjusted odds ratio". So, for example if one just looked at smoking and otitis 9
without looking at any other potential confounders, and found an odds ratio of 2; that would be 10
an unadjusted odds ratio. If after all the risk factors are adjusted for, the odds ratio is still
2, then 11
this is much more meaningful than just looking at the unadjusted number. It allows us to
say that 12
after controlling for age, sex, and maternal education etc. there is an independent association of 13
passive smoking and otitis. 14
Q. Are there particular concerns with respect to the distinction between pre and post- 15
natal exposure? 16
A. Yes. This issue is particularly relevant in light of the findings of the Stathis study,
which 17
did distinguish between prenatal and postnatal exposure, and found that prenatal smoking
is more 18
important than postnatal smoking with respect to otitis media risk. Therefore, studies that
lump 19
together prenatal and postnatal smoking (especially if they "control for " low birth weight
and 20
other manifestations of prenatal smoking) are likely to miss a real effect of maternal smoking. 21
Q. Are there additional reasons why pre and post natal exposure should be 22
distinguished? 23
A. Yes. Many women stop smoking temporarily during pregnancy, but if that is the

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critical 24

period for causing the damage that leads to ear problems, then current smoking at 1 year
or 5 1
years will not be a good marker for relevant exposure. Therefore, studies that only use smoking 2
after birth as a measure of exposure will generate misleading results. 3
Q. Can you summarize the quantitative findings of the Stathis study? 4
A. As exposure to tobacco smoke increased, the risk of acute otitis increased with a dose
5
response effect. 6
Q. Can you explain this? 7
A. Yes, those who smoked 1-9 cigarettes/day had an OR of 1.6; those who smoked 10-19 8
cigarettes had an OR of 2.6; those who smoked 20 or more cigarettes had an OR of 3.3. 9
Q. Dr. Weitzman, in your opinion was this a well-implemented study? 10
A. Overall this was a good methodology, although it employed non-medical definitions of 11
ear disease. It did employ useful epidemiologic definitions, and the sample size was large. In 12
addition, this study distinguished between prenatal and postnatal smoking which made it better 13
than studies which did not draw that distinction, because that has caused some confusion
in the 14
past with respect to measuring relevant exposure. This study suggests that previous studies may 15
be mixing apples and oranges by not distinguishing between prenatal and postnatal smoking 16
essentially washing out an effect of maternal smoking by putting mothers who didn't smoke 17
during pregnancy in together with those who did. 18
Q. What would you characterize as the importance of these three studies taken 19
together? 20
A. These studies together help fill in the information gaps left by the previously reviewed
21
papers since they do provide objective (cotinine) information about the duration and intensity of 22
exposure, and specifically address the distinction between prenatal vs. postnatal exposure. 23
Q. Did any of the studies you have relied upon in your report have any weaknesses you 24

feel should be addressed? 1
A. Yes. One study (Lubianco Neto, 1999) had a much weaker design than all the others 2
insofar as it was cross-sectional and excluded all children with any previous acute otitis
media. 3
This essentially made it like a point-prevalence study. 4
Q. What is a point-prevalence study? 5
A. That is where you measure occurrence of disease at one point in time, rather than over
a 6
long period. Instead of asking how many ear infections children had in the last year, for
example, 7
they just looked at who happened to be having an ear ache at the time of the study contact. 8
Q. Why is this a problem? 9
A. Because it makes it impossible to look at long-term exposures and long-term

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outcomes. 10
Such a design might make sense if environmental tobacco smoke was hypothesized to cause 11
acute otitis media immediately following intermittent exposure, but environmental tobacco 12
smoke is a chronic exposure that is thought to begin causing problems even before birth.
13
Q. What did the Lubianco study conclude? 14
A. This study found a non-significant protective effect of environmental tobacco smoke but 15
any results are hard to interpret. 16
Q. Can you explain what a "non-significant protective effect of environmental tobacco 17
smoke" means? 18
A. A protective effect would mean that the risk of acute otitis media was actually lower
in 19
those exposed to environmental tobacco smoke. Non-significant means that, statistically,
the 20
results were likely due to chance. 21
Q. Why are these results hard to interpret? 22
A. Yes, they are hard to interpret. 23
Q. Why? 24

A. Because the results were statistically non-significant this study is by definition 1
“inconclusive” with respect to a link between environmental tobacco smoke and acute otitis 2
media so nothing should be inferred from it. This is in distinction to a significant
“negative” 3
study which is one that would have found a statistically significant protective effect. It is
not 4
clear however what one would make of the results of this study even if they had been
significant 5
because the design of the study was so bizarre. 6
Q. Were there any additional problems with design of studies you have relied on? 7
A. Yes. The ten remaining studies feature some minor problems with design or reporting, 8
but nevertheless provide meaningful information. 9
Q. Can you summarize those results for the Court? 10
A. Yes. 4 of the 10 studies reported a significant positive association of environmental 11
tobacco smoke and otitis media (relative risks from 1.3 to 4.6). As for the others, 3
reported a 12
positive association but did not provide numbers documenting significance, and 3
reported a non- 13
significant positive association. 14
Q. Do you know what it means to pool results from various studies? 15
A. Yes, as we previously discussed with regards to meta-analysis, it involves counting up
the 16
data from the different studies and analyzing them as if they were one big study. 17
Q. Can you pool the results from those 10 studies? 18
A. Not meaningfully, because the outcomes, exposure measures, populations, and designs
19
vary so much. In order to do a legitimate meta-analysis, one must start with comparable
studies, 20
and not mix apples and oranges. 21
Q. Are the data, though, consistent with the findings from previous reports? 22
A. Yes. Indeed, if one focuses on the newest studies with the strongest designs, the risk of

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23
acute otitis media and otitis media with effusion from environmental tobacco smoke appears to 24

be even higher than previously reported. 1
Q. Have you reviewed any reports that hypothesized biologic mechanisms whereby 2
environmental tobacco smoke may increase Eustachian tube dysfunction and thereby 3
contribute to otitis media? 4
A. Yes. The California EPA/NCI report hypothesized four such mechanisms: 5
1) A decreased mucociliary clearance that promoted entry of microbes; 6
2) A hyperplasia of adenoids that reduced Eustachian tube patency; 7
3) A mucosal swelling that reduced Eustachian tube patency; and/or 8
4) An increase in frequency of URIs (colds) that caused factors 1-3. 9
Q. Can you explain each of the hypothesized biologic mechanisms in more detail? 10
A. Yes. Let us look again at the diagram of the ear. Tobacco smoke is thought to damage 11
the tiny projections (cilia) which sweep out debris from the respiratory tract as well as the 12
mucus membranes which line the respiratory tract. This damage impairs the ability to protect oneself 13
against germs. In addition, any irritation or infection of the upper respiratory tract could 14
cause inflammation of the adenoid and block the drainage of the Eustachian tube. Finally, swelling of 15
the membranes lining the Eustachian tube itself would also block drainage, thereby increasing the 16
risk of stagnant fluid which can cause infection. 17
Q. Is there any other evidence that secondhand smoke may contribute to otitis media? 18
A. There is evidence that secondhand smoke impairs immune system function, increases the 19
risk of low birth weight and birth defects, and promotes the growth of oral bacteria, all of 20
which could contribute to otitis media. 21
Q. What did you conclude through your analysis of the epidemiological studies and 22
related articles regarding otitis media and environmental tobacco smoke? 23
A. The accumulated information on environmental tobacco smoke and both acute otitis 24

media and otitis media with effusion is highly consistent with a causal relationship and 1
the most recent data suggest that the risk of otitis media is approximately doubled by environmental 2
tobacco smoke exposure, and that heavy maternal smoking during pregnancy is likely the most 3
damaging exposure. This implies significant pediatric morbidity and resulting medical 4
expenditures for otitis media attributable to environmental tobacco smoke. 5
Q. Dr. Weitzman, let’s move on to your next opinion. As a pediatrician, are you 6
familiar with the medical condition known as SIDS? 7
A. Yes. SIDS is an acronym for Sudden Infant Death Syndrome. 8
Q. What is it? 9
A. SIDS is defined as the “sudden death of an infant under 1 year of age that remains 10
unexplained after a thorough case investigation, including performance of a complete autopsy, 11
examination of the death scene, and review of the clinical history.” 12

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Q. Is SIDS a rare occurrence in the United States? 13
A. No. While it kills fewer than 1 of every 1,000 children born each year, it is the number
14
one cause of death for infants between 1 month and 1 year of age. 15
Q. How do you know that? 16
A. Data from the National Center for Health Statistics. 17
Q. Is SIDS a serious problem in the rest of the world as well? 18
A. Yes it is. In fact, SIDS was particularly high in some other countries like New Zealand. 19
Q. Has a biologic mechanism for SIDS ever been discovered? 20
A. A biologic mechanism for SIDS remains unknown. However, through the use of 21
epidemiological research, a number of causes have been identified. In fact, epidemiology
has 22
provided the most important and conclusive contributions to an understanding of the disorder. 23
Q. What are some of the causes for SIDS? 24
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A. One major cause has been the prone (on the belly) sleeping position. Following the 1
success of the Back to Sleep campaign, which has significantly reduced the SIDS rate, passive 2
smoking has emerged as a currently recognized cause. Other characteristics involved relate to 3
the mother’s behavior or even the infant himself. 4
Q. Can they be categorized? 5
A. Overall, they can be placed into three categories. One category involves those relating
to 6
the mother or the pregnancy itself. 7
Q. And what are these? 8
A. They include maternal smoking, maternal age under 20, poor prenatal care, social 9
deprivation, low birth weight, prematurity, multiple births and being born small for gestational 10
age. 11
Q. And what is another category? 12
A. Infant factors, like the male sex. 13
Q. What is the last category? 14
A. The last category involves environmental factors like prone sleeping, the winter season, 15
soft sleeping surfaces, loose bedding, and postnatal tobacco smoke. 16
Q. Of all these listed, have any stood out as being the most serious? 17
A. Sleeping in the prone position and maternal smoking. 18
Q. Why do these two stand out for you? 19
A. Because they have been associated with the biggest attributable risk fraction and because 20
they are potentially preventable. 21
Q. Let's deal with sleeping in the prone position first. What has occurred to make this 22
so important for SIDS? 23
A. Many studies have been performed all over the world indicating that prone sleeping was a 24

major risk factor for SIDS. 1
Q. You mentioned the “Back To Sleep” Program. What is this program? 2
A. The “Back To Sleep” Program is a public health campaign under the direction of the NIH 3
and other partners that encourages parents to place their infants in a supine position (on
their 4
backs) for sleeping. Hence the term “back to sleep.” 5
Q. What was the result of these public health campaigns? 6
A. A dramatic decrease in the SIDS occurrence rate. 7

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Q. How dramatic was the decrease? 8
A. The incidence of SIDS has decreased almost 50% in this country since the American 9
Academy of Pediatrics statement on infant positioning in 1992 and the Back to Sleep campaign 10
which started in 1994. 11
Q. Why was this change from a prone sleeping position so successful in reducing the 12
SIDS occurrence rate? 13
A. Simply because it was successful. The proof is in the pudding. Epidemiology and public 14
health science is about what works. Back to Sleep is based entirely on epidemiology research, 15
not on any basic science work. The best science on SIDS, i.e. the epidemiology, indicated
that 16
prone sleeping was a major cause; so it made sense to try out an intervention based on that 17
research. 18
Q. So, if pediatricians are unsure as to why these campaigns worked, how can we say 19
that the reduction in the number of infants sleeping in the prone position was directly 20
related to the reduction in the SIDS rate? 21
A. In every country where a Back to Sleep style campaign has been done, there has been a 22
huge drop in SIDS after, but never before, the supine sleeping campaign was initiated. In
the 23
Netherlands in the 1970s, there was a national campaign to promote prone sleeping and SIDS 24

went up. The best explanation for all these experiences as well as the epidemiologic research 1
findings is that prone sleeping is a causal determinant of SIDS. 2
Q. What impact did these events have on the importance of maternal smoking with 3
regard to SIDS? 4
A. Because of the rapid decline in the practice of prone positioning of infants, coupled
with a 5
much slower decline in smoking among young women, passive smoking is now a major 6
recognized cause of SIDS. 7
Q. Have any studies been performed to determine if maternal smoking is linked in any 8
fashion to SIDS? 9
A. Yes. Many studies have been performed. 10
Q. And what have those studies shown? 11
A. That passive smoking, especially postnatal maternal smoking, causes SIDS. 12
Q. Has the federal government studied this issue? 13
A. Yes. In the latest Surgeon General's Report, entitled "The Health Consequences of 14
Smoking," the Government undertook a systematic review of the literature regarding smoking 15
and SIDS. The Report concluded that "[t]he evidence is sufficient to infer a causal relationship 16
between sudden infant death syndrome and maternal smoking during and after pregnancy." 17
Q. Has anyone else studied the data? 18
A. The World Health Organization, National Cancer Institute, and the Surgeon General have 19
also studied the data. 20
Q. Can you provide a summary of their findings? 21
A. Yes. Overall, these reviews have reached the same conclusion, that secondhand smoke 22

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causes SIDS. In fact, the Surgeon General’s most recent report on the health effects of smoking, 23
published earlier this year, states that there is now enough data to conclude that this link
is causal 24

in nature. 1
Q. Has this issue been studied by many individual researchers as well? 2
A. Yes. 3
Q. Let's discuss a few of those studies. Dr. Weitzman, are you familiar with an article 4
titled "Passive Smoking and Sudden Infant Death Syndrome: Review of the Epidemiological 5
Evidence?” 6
A. Yes, I am. 7
Q. Where did it appear? 8
A. It appeared in the medical journal Thorax. 9
Q. When was it published? 10
A. It was published in 1997. 11
Q. Who were the authors? 12
A. Professor H. Ross Anderson and Derek G. Cook of the Department of Public Health 13
Sciences for the St. George's Hospital Medical School in London, England. 14
Q. Is this a good article on the association between secondhand smoke and SIDS? 15
A. Yes, it is. 16
Q. Why? 17
A. The journal Thorax published a whole series of articles on the health consequences of 18
passive smoking. The authors of these articles performed thorough systematic reviews of the 19
existing literature. 20
Q. What was the purpose of this paper? 21
A. The paper was a systematic quantitative review of the literature on passive smoking and 22
SIDS. 23
Q. How were these studies selected? 24

A. These were studies with relevant quantitative information, initially identified by a 1
computerized search of the medical literature. 2
Q. What studies were selected? 3
A. 39 studies were reviewed, including 10 cohort studies and 29 case-control studies. 4
Q. What are cohort studies? 5
A. The main feature of a cohort study is the observation of large numbers over a long period 6
of time (commonly years) with comparison of incidence rates in groups that differ in exposure 7
levels. So, cohort studies start with a group of exposed and another group of unexposed people 8
and then compare the occurrence of disease in the two groups. 9
Q. What did the 10 cohort studies involve? 10
A. The cohort studies selected here were either planned epidemiological studies of 11
pregnancy and the perinatal period or cohorts constructed from national or regional databases that 12
contained information about maternal smoking during pregnancy. 13
Q. Did these cohort studies have any benefits compared to other studies? 14
A. Yes, cohort studies often provide stronger evidence than case-control studies, because 15
they are generally prospective, so there is less potential for bias in the reporting of smoking and 16
other harmful behaviors. The data often come from large national databases. 17

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Q. Did these cohort studies have any disadvantages? 18
A. Yes. They often failed to differentiate between prenatal vs. postnatal passive smoking.
19
Overall, they tended to lack detailed information about the postnatal circumstances of the
infants. 20
Q. What is the effect of this lack of information? 21
A. The distinction between prenatal vs. postnatal maternal smoking is problematic because 22
most women either smoke or do not smoke; the vast majority of mothers who smoke after 23
pregnancy smoked during pregnancy as well, and vice versa. Studies that lump together prenatal 24
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and postnatal smoking (especially if they “control for” low birth weight and other manifestations 1
of prenatal smoking) are therefore likely to miss a real effect of maternal smoking. Moreover, 2
many women stop smoking temporarily during pregnancy, but if that is the critical period
for 3
causing the damage that leads to problems, then current smoking at 1 year or 5 years will
not be a 4
good marker for relevant exposure, so studies that only use smoking after birth as a measure of 5
exposure will also find misleading results. Essentially, the lack of information on postnatal 6
circumstances of the infants means less ability to control for confounders. 7
Q. What is a confounding factor? 8
A. A confounding factor has been defined as a variable that can cause the outcome of 9
interest, is not an intermediate variable, and is associated with the factor under investigation. 10
Q. Can a confounder cause bias? 11
A. Yes, bias can occur when adjustment is made for any factor that is caused in part by the 12
exposure and is also correlated with the outcome. 13
Q. How would you deal with a confounder in the context of the smoking issue? 14
A. If low birth weight (LBW) and secondhand smoke go together and one thinks that low 15
birth weight is the true cause of SIDS rather than secondhand smoke, it would be important to 16
adjust for low birth weight in a study of secondhand smoke and SIDS because the relation may 17
be confounded by this factor. That is to say, secondhand smoke may just be a “marker” for low 18
birth weight. 19
Q. Is there a risk in doing this? 20
A. Yes. If low birth weight is caused by secondhand smoke, then it would be inappropriate 21
to control for it because that would bias the study against finding a secondhand smoke effect. In 22
this scenario, low birth weight isn’t an independent cause of SIDS; it’s another effect of
23
secondhand smoke. Controlling for it in this case would be “over-controlling” and would 24

“mask” a true effect of secondhand smoke. 1
Q. Did this article review other studies? 2
A. Yes. The article reviewed 29 case-control studies. 3
Q. What is a case control study? 4

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A. A case control study has been defined as an observational epidemiologic study of persons 5
with the disease of interest and a suitable control group of persons without the disease.
The past 6
history of exposure to a suspected cause is compared between cases and controls. 7
Q. What are “controls?” 8
A. Controls have been defined as people who resemble the cases in respects such as age and 9
sex but do not have the disease of interest. 10
Q. Are case control studies prospective or retrospective in nature? 11
A. Case-control studies are generally retrospective, i.e. starting with present cases and 12
looking backwards in time for exposures. 13
Q. Are there particular diseases for which such studies are more useful? 14
A. Yes. They are more useful for relatively uncommon diseases like SIDS. 15
Q. How did these case control studies work? 16
A. If SIDS affects one baby in 10,000, then a cohort study would need to follow 1 million
17
infants to get 100 cases, whereas a case control study would start with just the 100 cases
and then 18
find 100 or 200 controls for comparison. This is much more feasible, affordable and conducive 19
to getting detailed information. 20
Q. What were some of the more recent studies like? 21
A. Some were both very large and very comprehensive in the variables assessed. And these 22
studies yielded the most useful information about postnatal smoking and SIDS. 23
Q. In looking at all of these studies as a whole, what were the main categories of 24
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confounding factors that they examined? 1
A. Among the main factors that were examined were age, parity, gestational age, birth 2
weight, sex of the infant, sleep position, and bedding. 3
Q. Did all the studies use the same number and/or types of confounding factors? 4
A. No. There was variation in the number and types of confounding factors. 5
Q. On the issue of prenatal smoking, how many studies reported it? 6
A. All but one of the 39 studies. 7
Q. Are you familiar with the term “odds ratio?” 8
A. Yes, I am. 9
Q. What is it? 10
A. The odds ratio is the ratio of the odds of exposure in the cases over the odds of exposure 11
in non cases in perspective studies. In other words, it is an estimate of the risk ratio. 12
Q. Can you please provide an example? 13
A. If 60% of smokers cough, the probability of coughing is 60% but the odds are 60%/40% 14
= 1.5. 15
Q. What is considered a strong odds ratio? 16
A. Some people would say anything over 2 is strong but there is no absolute cut-off. From a 17
statistical standpoint, as long as the 95% confidence interval for the OR does not include
1, then 18
it is a significant OR. From a public health standpoint, what matters is the attributable
risk. 19
Q. Why does the attributable risk matter? 20
A. Stolley and Lasky stated that “[w]hile a high Risk Ratio or OR is important in 21
establishing that an exposure causes a given disease, a lower Risk Ratio can be important

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as well. 22
For example, a high Risk Ratio of 20 for smokers and lung cancer, a crucial fact in understanding 23
the causal relationship between smoking and lung cancer. The much lower Risk Ratio of 1.2 24
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associated with passive smoking […] and lung cancer is less dramatic evidence for a causal 1
relationship, but it is still important because passive smoking may affect many more people. A 2
Risk Ratio of 1.2 means that passive smoking increases one's risk of lung cancer by 20 percent. 3
To an individual, a 20-percent increase in low risk – say from a probability of 1.0 in a
1,000 to 4
1.2 in 1,000—may not substantially change the overall level of risk. But in the case of passive 5
smoking, since large segments of the population are exposed to passive smoke, a 20-percent 6
increase in risk can result in a substantial increase in the number of people with cancer
whose 7
disease can be attributable to passive smoking. A low risk ratio can produce high ARs – large 8
number of affected people—and thus have important consequences for public health." 9
Q. What were the results like for those studies that made adjustments for confounding 10
factors? 11
A. The summary estimate for the adjusted OR was 2.11. In other words, prenatal smoking 12
more than doubled the risk of SIDS. 13
Q. Was the association between prenatal smoking and SIDS affected by whether a 14
cohort or case control study was employed? 15
A. No. 16
Q. Was a causal relationship between prenatal smoking and SIDS found? 17
A. Yes. The association between prenatal smoking and SIDS was found to possess many of 18
the characteristics of a causal relationship. 19
Q. What characteristics are demonstrated? 20
A. The following characteristics were demonstrated: Consistency across various study 21
designs, environments and investigations; strength of the association; a degree of specificity in 22
relation to other causes of infant death (for other potential causes, secondhand smoke had
a much 23
lower OR. Also, the secondhand smoke –SIDS relationship remains after controlling for 24

confounders.); a dose-response relationship; a temporal relationship; existence of logical
1
plausibility; and coherence with other research showing harm to the respiratory system from 2
secondhand smoke. 3
Q. What else did the authors conclude? 4
A. The authors concluded that "[t]he evidence is suggestive of an effect of ETS independent 5
of any intrauterine effect. […] the epidemiological evidence points to a causal relationship 6
between SIDS and postnatal exposure to tobacco smoke." 7
Q. How was this article received? 8
A. It was received very well by the public health community. 9

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Q. Are the conclusions presented in this article still valid today? 10
A. Yes, they are. Their findings have not been refuted by subsequent research. 11
Q. Let's discuss another of those studies. Dr. Weitzman, are you familiar with an 12
article titled "Risk Factors for Sudden Infant Death Syndrome Following the
Prevention 13
Campaign in New Zealand: A Prospective Study?" 14
A. Yes, I am. 15
Q. Where did it appear? 16
A. In Pediatrics, the official journal of the American Academy of Pediatrics and the
main
17
pediatrics journal in the Untied States. 18
Q. When was it published? 19
A. It was published in 1997. 20
Q. Who were the authors? 21
A. There were many authors who contributed to this article. The primary author was Dr.
22
Edwin A Mitchell, of the Department of Pediatrics at the University of Auckland in
Auckland, 23
New Zealand 24
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Q. Is this a good article on the association between secondhand smoke and SIDS? 1
A. Yes, it is. 2
Q. Why? 3
A. The data on the exposures were collected before the occurrence of the SIDS cases 4
studied. In addition, this is a national study with a large database. Finally, the
study heads
5
adjusted for a large number of confounders. 6
Q. What was the purpose of this paper? 7
A. The purpose of this paper was to identify the causes for SIDS following a national 8
campaign in New Zealand aimed at preventing SIDS. More specifically, there was a
focus on the 9
causes of SIDS remaining after so many had been prevented through the cessation of
prone 10
sleeping by infants. 11
Q. Can you please describe this national campaign for me? 12
A. New Zealand conducted a national public awareness campaign to reduce prone
sleeping. 13
Q. What were these other causes? 14
A. Maternal smoking was among them. 15
Q. How did the study work? 16
A. For two years, from October 1, 1991 through September 30, 1993, data was collected
by 17
community health nurses on all infants born in New Zealand. 18
Q. What type of data was collected? 19
A. The data included information on infant care practices and the amount of smoking 20
exposure. 21
Q. How often was this data collected? 22
A. It was collected twice. The first collection occurred at the nurses’ first contacts
with
the 23
infants, and the second collection occurred when the infants were two months old. 24
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Q. What other data was collected? 1
A. Data on many potential confounders including maternal factors, pregnancy factors,
and 2
infant variables was collected. 3
Q. When was this data collected? 4
A. From around the time of birth until about 2 months of age. 5
Q. During this study, how many SIDS cases occurred? 6
A. 127 cases were reported. 7
Q. What did the results show? 8

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A. The OR for maternal smoking and SIDS was around 5. The population attributable risk 9
for this was 45%. In other words, almost half of SIDS cases could have been prevented if
10
maternal smoking were stopped. 11
Q. What did this mean for the importance of maternal smoking with regard to SIDS? 12
A. Maternal smoking is the number one cause for SIDS now that prone sleeping has been
13
successfully decreased. 14
Q. Did the authors have any final conclusions? 15
A. They concluded that maternal smoking is common in New Zealand and with the 16
reduction in the prevalence of prone sleeping, is now a major cause of SIDS there. 17
Q. How was this article received when it was published? 18
A. Very well. It has been cited dozens of times in the literature and as far as I know has
19
never been challenged with respect to its methods or findings. 20
Q. Are the conclusions reached by the article still valid today? 21
A. Yes. The findings are based on solid research. Overall it is more relevant to today’s 22
situation than the studies conducted before “Back to Sleep,” such as the ones reviewed by
23
Anderson and Cook that were discussed earlier in this testimony. 24

Q. Dr. Weitzman, are you familiar with an article titled "Case-Control Study Of 1
Current Validity Of Previously Described Risk Factors For SIDS In The Netherlands?" 2
A. Yes, I am. 3
Q. Where did it appear? 4
A. It appeared in Archives of Disease in Childhood, the main pediatrics journal in the United 5
Kingdom. 6
Q. When was it published? 7
A. It was published in 1998. 8
Q. Who were the authors? 9
A. There were several authors for this paper. The primary author was Dr. M.P. L’Hoir, from 10
the University Hospital Utrecht/Wilhemina Children’s Hospital in the Netherlands. 11
Q. Is this a good article on the association between secondhand smoke and SIDS? 12
A. Yes, it is. 13
Q. Why? 14
A. Although the sample size is not as big as one might like, it is a national sample. In 15
addition, it is an interesting study because it made a special effort to look at some of the
16
outstanding questions to be answered, such as the role of postnatal smoking specifically.
17
Q. What was the purpose of this paper? 18
A. To assess whether previously established characteristics associated with SIDS retained
19
their validity in the face of the reduced incidence of SIDS. 20
Q. Did the study categorize them? 21
A. Yes, it did. They were grouped as “mutable and immutable” for the purpose of the 22
analysis. 23
Q. What does “mutable” mean? 24

A. Mutable factors are factors or circumstances that are able to be changed or altered,

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thus 1
making them amenable to prevention. 2
Q. What does “immutable” mean? 3
A. Immutable factors are factors or circumstances that cannot be changed or altered. 4
Q. What were the mutable factors? 5
A. Passive smoking, maternal alcohol consumption, breast feeding, changes in infant care, 6
prone sleeping, and bed sharing. 7
Q. What were the immutable factors? 8
A. Maternal age, parity, birth weight, and socioeconomic status. 9
Q. How many subjects participated in the study? 10
A. 73 cases and 146 controls participated in the study. 11
Q. Did the study make any adjustments in its statistics? 12
A. Yes. They adjusted for multiple variables using stepwise multiple logistic regression
13
statistics. 14
Q. What did the study discover with regard to smoking and SIDS? 15
A. It discovered that parental postnatal passive smoking yielded a significant result. 16
Q. How significant was the result? 17
A. It revealed an odds ratio of 6, an extremely high number by any standard. 18
Q. What does an occurrence ration of 6 mean? 19
A. It means that after adjusting for all other factors, children exposed to parental postnatal
20
passive smoking were six times more likely to die of SIDS compared to those children who did 21
not experience this exposure. 22
Q. What else did it discover on this issue? 23
A. It discovered that like other past studies, there was a dose-response effect with smoking. 24

Q. What is a dose-response effect? 1
A. As the exposure to cigarettes increased from 0, to 1-9 cigarettes per day, to 10 cigarettes 2
or more, the relative risk of SIDS increased from 1 to 2.82 to 5.97, a significant increase
in this 3
figure. 4
Q. How was this article received when it was published? 5
A. It was very well received. 6
Q. Are its conclusions still valid today? 7
A. Yes. The findings are based on solid research. Overall it is more relevant to today’s 8
situation than the studies conducted before “Back to Sleep”, such as the ones reviewed by
9
Anderson and Cook that we just discussed previously. 10
Q. Dr. Weitzman, are you familiar with an article titled "A Prospective Study Of 11
Smoking During Pregnancy And SIDS?" 12
A. Yes, I am. 13
Q. Where did it appear? 14
A. It appeared in Archives of Disease in Childhood, the main pediatrics journal in the United 15
Kingdom. 16
Q. When was it published? 17
A. It was published in 2000. 18
Q. Who authored the article? 19
A. There were several authors. The primary author was Dr. Kristen Wisborg of the Prenatal 20
Epidemiological Research Unit for the Department of Gynecology and Obstetrics at the Aarhus 21

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University Hospital in Denmark. 22
Q. Is this a good article on the association between secondhand smoke and SIDS? 23
A. Yes, it is. 24
Written Direct: Michael Weitzman, M.D., U.S. v. PM 99-cv-02496 (D.D.C.) (GK) Page 92
Q. Why? 1
A. The strengths of this study were its ability to adjust for a number of potential confounders 2
and the fact that the information about smoking during pregnancy was obtained prospectively. 3
Q. What was the purpose of this paper? 4
A. To study the association between maternal smoking during pregnancy and SIDS. 5
Q. How was it to do that? 6
A. It would do so through the use of prospectively collected data from a university ward.
7
Q. What was this prospectively collected data? 8
A. The data originated from a questionnaire collecting information such as the number of
9
cigarettes smoked. 10
Q. What was the purpose of collecting this data prospectively, or before birth and/or 11
the occurrence of SIDS? 12
A. Recall bias is reduced by obtaining information before the occurrence of SIDS. Given all 13
the negative publicity in recent years about smoking, women whose babies have just died may be 14
expected to deny being smokers if they feel that would make them responsible for their babies' 15
deaths. 16
Q. One of the information categories involved smoking. How were the different levels 17
of smoking classified in the study? 18
A. They were classified by the number of cigarettes smoked per day. Three categories were 19
created: 0 cigarettes per day, 1-9 cigarettes per day, and 10+ cigarettes per day. 20
Q. What did the study discover? 21
A. It discovered that children of smokers had more than 3 times the risk of SIDS, and that
22
the risk of SIDS increased with the number of cigarettes smoked per day. 23
Q. Did the study adjust for any confounding factors? 24
Written Direct: Michael Weitzman, M.D., U.S. v. PM 99-cv-02496 (D.D.C.) (GK) Page 93
A. Yes. It adjusted for parity, alcohol, caffeine, maternal height and weight, education, 1
occupation, marital status and prenatal care. 2
Q. Did the adjustment for these confounding factors substantially impact the results? 3
A. The adjustment for these confounders did not change the results. 4
Q. Was there any reduction caused by any confounding factor? 5
A. Yes. The adjustment for maternal age marginally reduced the risk from 3.5 to 3.0. 6
Q. What did the study conclude? 7
A. That in a population with 30% pregnant smokers, 30-40% of all SIDS occurrences could 8
be avoided if all women stopped smoking during pregnancy. 9
Q. Were the results of this study accepted by the public health community? 10
A. Yes, the results were accepted by the community. 11
Q. Are the results of this study still valid today? 12
A. Yes. The findings are based on solid research. In addition, like the previously discussed 13
studies, it is more relevant overall to today's situation than the studies conducted before
"Back to 14

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Sleep”, such as the ones reviewed by Anderson and Cook that we just discussed previously.
Q. Dr. Weitzman, I would like to discuss the causes of SIDS. Has the medical community been able to establish a biological mechanism by which passive smoking causes SIDS?
A. No. there are various hypotheses available to establish biological plausibility for passive smoking causing SIDS but there is no established mechanism.
Q. Why not?
A. Because the basic scientists have not yet discovered a biological mechanism for the proximal cause of SIDS.
Q. Dr. Weitzman, in your opinion, is the lack of a biological mechanism for SIDS important to your opinion that secondhand smoke causes SIDS?

A. Not really. It would be helpful if it existed, but it is not essential. For the vast majority of medical conditions that physicians treat and prevent, we do not know the biological mechanism of the cause or causes.
Q. Dr. Weitzman, in your opinion, is the fact that no biological mechanism for SIDS has been conclusively determined fatal to your opinion that secondhand smoke causes SIDS?
A. No, it is not. First of all, I would like to clarify that the proposition that secondhand smoke causes SIDS is not a matter of my subjective personal opinion. What I describe here is the scientific evidence from many rigorous studies. The overall conclusion to be reached from the weight of the best evidence is that secondhand smoke is a major recognized cause of SIDS.
Q. You hold this opinion even though there is no definite biological mechanism for SIDS?
A. Yes. Epidemiology has often been way ahead of the biological sciences in discovering ways to fight disease and save people’s lives. If what you want is to solve interesting intellectual puzzles, then you can keep doing laboratory experiments forever because there will always be another layer of questions brought up by each answer. Einstein said “as the circle of light increases, so does the circumference of darkness around it.” But if you want to save lives, you look at the best evidence available today, you base a treatment idea on that and you test it and keep testing it to make sure it’s helping people – you do epidemiologic evaluation research.
Q. And how does this apply here?
A. If you have good data identifying modifiable causes for SIDS, leading to the death of infants, then you should do something with that and save babies’ lives. Doing nothing just because no one knows the biochemical or cellular mechanism would be irresponsibly

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crazy and 24

inconsistent with medical and public health policy and practice. 1
Q. Can you think of any other instances where the medical community took action with 2
regard to a health problem without fully understanding the mechanism? 3
A. There have been numerous instances where the health community has acted this way. 4
One example that is immediately relevant to the problem of SIDS itself involves the Back
To 5
Sleep campaign, but I would be glad to give numerous other examples. 6
Q. What is/was the Back To Sleep Campaign? 7
A. As I said earlier, the Back To Sleep campaign was public awareness campaign at a 8
national level in the U.S. to encourage parents to put babies on their backs to sleep (the
supine 9
position) instead of on their bellies (the prone position). 10
Q. Did researchers know why sleeping in the prone position had become such an 11
important risk factor for SIDS? 12
A. Doctors had been recommending the prone position because of a belief that it would help 13
prevent reflux of food from the stomach to the esophagus. Biologically, this made sense but 14
there was no epidemiologic evidence to support such a recommendation. And it did more harm 15
than good, for as prone sleeping increased, SIDS increased. This was seen dramatically and 16
tragically in the Netherlands. 17
Q. Did they know why sleeping in the prone position significantly increased the risk of 18
SIDS? 19
A. No, they did not. 20
Q. So, what did the public health community do in response to the discovery of this 21
important new information? 22
A. In New Zealand which performed epidemiology research on SIDS early on, the public 23
health community responded with national prevention programs in 1991. In 1992, the American 24

Academy of Pediatrics officially recommended supine positioning for when babies slept. In 1
1994, the National Back to Sleep campaign was launched. 2
Q. And what were the results of the Back To Sleep Campaign? 3
A. A dramatic decrease in SIDS deaths. 4
Q. How significant was this reduction? 5
A. The reduction was about 50%. 6
Q. Any other instances where the medical community took action with regard to a 7
health problem without fully understanding the health problem? 8
A. Yes. John Snow and Florence Nightingale were preventing deaths from infectious 9
disease before the Germ theory. The two identified a problem, surveyed subjects and recorded 10
their results. This allowed them to identify key public health improvements that saved countless 11
lives. In addition, the British Navy was preventing deaths from scurvy a century before the 12
discovery of Vitamin C. Finally, the link between smoking and cancer was discovered long 13
before the National Cancer Institute was created. I could go on as there are many examples that 14
have saved millions of lives. 15
Q. Do you have any final opinions regarding secondhand smoke and SIDS that you

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16
would like to make? 17
A. Yes, I do. The accumulated weight of the best evidence on maternal smoking and SIDS 18
is highly consistent with a causal relationship. Given the overwhelming evidence linking
19
maternal smoking to SIDS, it should be a major national health priority to develop effective 20
strategies to reduce smoking generally and among young women in particular. 21
Q. Thank you, Dr. Weitzman. 22

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